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Measuring Instrument Technique

Physical Society's Contribution

THE three-day display of measuring and recording instruments arranged annually by the Physical Society is probably unique among exhibitions. There is an atmosphere about it which could not be preserved if it were to be held in different circumstances elsewhere. Thus the generous toleration with which the Imperial College of Science and Technology permits some of its South Kensington laboratories to be temporarily adapted for the purpose, involving hurried restoration to their normal teaching functions, is gratefully acknowledged, for the descent of this technico-social function to the level of a trade show in the ordinarily accepted sense of that term would generally be deplored.

The exhibition has grown to its present considerable dimensions from a few items casually demonstrated at an evening conversazione and it happens that its originator, Mr. R. W. Paul, is chairman of the Exhibition Committee this year, the twenty-ninth of the series. Abstentions about balanced new participants so that the net number of exhibitors remained much the same last week at about 84 in the Trade Section with 27 (ten fewer than last year) in the Research and Educational Section.

Avoiding Overcrowding

But limitation of individual stand size enabled them all to be accommodated in fewer rooms than were needed three or four years ago, an improvement that tends to overcrowd both visitors and exhibits and might be remedied by somewhat more circumscribed distribution of tickets and closer compliance with such rules as give preference to new apparatus and deprecate the display of more than one model of the same instrument.

Our forecast last week and Capt. B. S. Cohen's commentary (on another page) will indicate the less satisfying character of this year's effort. Relatively little outstanding development could be detected among too large a proportion of familiar equipment. Scarcely half those who attend can do so with professional motives and the main appeal is no longer to physicists. Even a few flameproof mining instruments were represented this season, but adaptability is the only safeguard against changing circumstances as was demonstrated by the appearance, also for the first time, of a range of electrically actuated aircraft instruments.

Other signs of the times were the selections of equipment of B.S.I. sub-standard accuracy offered by at least ten manufacturers for watt-hour meter testing in accordance with the requirements of the Electricity Supply (Meters) Act, 1936. Medical appliances are also increasing in number and variety of makes, but educational instruments are not so much in evidence nowadays, though some half dozen makers had specially contrived products in this class.

One notable tendency is in the naming of familiar components adapted to fresh needs, now becoming more functional rather than purely operative, and so much more recognisable to the prospective user outside the electrical industry. One of many examples is the moisture meter for the timber industry, which would formerly have been termed a resistance ohmmeter. Contrast this with an instrument for measuring circuit "Q" (ω L/R) and of innumerable other applications.

The new Factory Act gives added importance to portable light-meters. Although some of these useful instruments are of the "vest pocket" size they have the characteristics of much larger portable street lighting types with which it is now possible to measure 0.005 foot-candle—half the recognised minimum. The assistance provided by photoelectric cells, which has facilitated the design of such photometric adaptations as colorimeters, gloss meters, turbidometers and the like, is extending into pyrometry and potentiometric control.

Thermionic Valve Meters

Thermal and metal-rectifier types of instruments will probably satisfy most common frequency requirements, particularly when small size and low cost are essential, but the importance of thermionic valve meters is being rapidly appreciated. They are now made self-contained and generally operate from AC mains, differing little in overall size and portability from other multi-range test sets. They are less liable to mechanical shock and electrical overload. Amplifier-type valve-operated instruments are capable of many important applications where the power available is very small, as is pointed out in an I.E.E. paper to which reference is made on page 55.

A concluding observation is the increasing extent to which laboratory furnishers and scientific investigators in general are adopting electrical means of operation and regulatory control.

Water Heating

IF there is a variety of opinions on cooker design, in the water-heating sphere their name is legion, as the discussion of Mr. J. I. Bernard's I.E.E. paper last week revealed. It is a sphere in which that nebulous individual, the "average consumer," has less definition than ever, and Mr. Bernard was wise to counsel discretion in estimating the amount of hot water likely to be used in any particular house. The matter is still further complicated by the variations in the water itself and in the design and situation of houses, to say nothing of other factors. It would be impossible, or at least too expensive, to design a water-heating installation for each consumer. Apparently the best that can be done is to divide households into broad classes and provide each class with the system best suited to its needs. Water heating can be a useful "valley filling" load, particularly during the summer, and is worth intensive research by supply authorities, and we recommend a close study of Mr. Bernard's paper and the discussion which is reported in this issue.

Indirect Grid Supplies

ANOTHER of those complicated questions regarding bulk supply terms has arisen in connection with the expiring agreement between Heston and Isleworth and the Metropolitan Electric Supply Co. Under the 1926 Act, the Corporation would receive an indirect supply from the grid *via* the transmission system of the company, which is obliged to hand on the same terms as it receives from the Central Electricity Board plus an allowance for the use of its mains. As supplies are given to other consumers from these mains there should be some saving, but it is not easy to decide how much of this should be allocated to any one tapping point, thus leaving an undesirably large margin for negotiation. It is sometimes suggested that if all bulk supplies could be taken direct from the Board, such transmission charges would not fall on individual undertakings. That is, however, to overlook the provision in the Act which permits the Board to protect itself from unreasonable expense in such cases, and as its connecting mains might be used exclusively for the one bulk supply, the service charges might even be higher than those asked for by a power company. In the present instance the Corporation has decided to call upon the Electricity Commissioners to determine the price to be paid. The Commissioners deserve sympathy in their task.

Amplification at the I.E.E.

IT is now some months since we announced that the I.E.E. was installing a microphone and speech amplifier in the lecture theatre by way of an experiment. By now we think it should have been possible to devise something satisfactory and likely to prove more or less permanent, but we regret that we cannot look upon the present arrangement as anything but unsatisfactory. If, at the conclusion of some lectures, the chairman had asked for a show of hands from those who had found difficulty in hearing, we believe the result might have astonished him and the lecturer. The microphone, to begin with, is far too directional so that, as the lecturer moves his head from side to side, there is a particular position when the speech is amplified to an extent which, coming as it does in sudden bursts, makes the speaker's remarks at that moment difficult to follow. Again, must we assume that some ten per cent. of the audience at the I.E.E. meeting are seriously deaf? Looking round the theatre one sees about that proportion straining to hear, often with cupped ears, whilst we suspect that lecturers, putting their trust in the microphone, drop their voices until the net result is worse than if there were no speech-amplifying arrangements. Surely the I.E.E. with the resources in talent which it can call upon should do better than this and give a lead rather than a horrid example in this matter of speech amplification.

Trolley-Buses

WHILE some 45 million kWh was lost to the electricity supply industry in 1937-38 as a consequence of the closing down of tramways in certain towns, there was a more than counterbalancing increase in the additional 56 million kWh taken by trolley-buses throughout the country. The net result was that 925 million kWh was used for passenger transport by road. Of the increase over the previous year, 43 million kWh was due to the trolley-bus system in London, which although not much more than half completed, has already proved markedly successful in improving the standard of travelling in the Metropolis. The latest Return of the Ministry of Transport (reviewed in this issue), which does not cover the London area, shows that in some smaller towns, where tramways have been abandoned as the tracks have worn out, oil-engined buses have been substituted. In some of these at least the headway between vehicles is obviously too small to bring in the revenue that would meet the standing charges on trolley-bus overhead equipment. For an example of what is being achieved when the traffic density is high enough to give scope to the trolley-bus, reference should be made to the fifth annual report of the London Passenger Transport Board.

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Bathroom Fatalities

SOMETHING must be done to prevent electrical bathroom accidents. Within the last week or so prominence has been given in the daily newspapers to the death of two women and a man as the result of the use of portable appliances in the bathroom—in two cases fires and in the other a reading lamp. The only party which can do anything effective is the supply undertaking, whose duty it is to safeguard electricity's reputation. It would be a simple and inexpensive matter to enclose a warning slip with the quarterly bill or instruct the meter reader to hand one to each consumer on his rounds. This should stress the danger of employing portable apparatus in a bathroom at all, but it could also suggest that a heater fixed out of the reach of the occupant of the bath might be employed, reference being made to the ceiling-type heaters now available. Housing authorities and contractors might also be approached to ensure that bathroom switches are fixed in a safe place.

Minimum Standards

IN their Regulations both the Electricity Commissioners and the I.E.E. save words by referring to British Standard Specifications. As there are still many appliances that are not covered by such Specifications, it was a good idea of the I.E.E. to request that an omnibus standard of minimum requirements should be set up to apply to these. The result, B.S. No. 816, is necessarily general in character and in some cases a little sketchy in outline, but it provides for the main safety and test requirements that ought to apply to all installations. It is intended as something to be going on with, since the items included will be transferred from the general to particular Specifications as and when they are issued.

Developing the Domestic Load

How a small but efficient undertaking is succeeding at Bridlington

MUCH mention was made in the historic Report of the McGowan Committee on Electricity Distribution of "small and inefficient undertakings." While it is true that this description cannot be considered inappropriate in a number of cases, it does not necessarily follow that because an undertaking is small it is inefficient. On the contrary, several of the smallest suppliers of electricity in the country have records of efficiency, progress and prosperity which many a larger undertaking might well be forgiven for envying.

These it is who are perhaps most perturbed—and justifiably so—regarding their future existence, and but for their wholehearted opposition a Bill might have made its appearance in Parliament long ago, and would probably have reached the Statute Book by this time.

Up-to-date new showrooms and offices are now being built in Quay Road *[Elec. Rev. photo.*

Among the municipalities responsible for the organisation of the opposition on behalf of the smaller electricity undertakings, a leading part was played by Bridlington. It was one of the first towns to support the Newcastle-under-Lyme Corporation in its opposition to the McGowan Report, and to rally round Mr. A. J. C. De Renzi, the borough electrical engineer and manager of the Newcastle-under-Lyme Electricity Department, while Colonel Josiah Wedgewood, M.P. for Newcastle-under-Lyme, and Major A. N. Braithwaite, M.P. for Buckrose, in which constituency Bridlington is situated, were the Members of Parliament who convened a meeting at the House of Commons to put before members the case of the smaller electricity undertakings against absorption as proposed by the McGowan Report. The town clerk of Bridlington (Mr. George Melvin) is an active and energetic member of the executive of the Committee of Smaller Municipal Electricity Supply Undertakings.

Explaining the advantages of a coffee percolator to a prospective purchaser at the Brett Street showrooms *[Elec. Rev. photo.*

Cookers are now being connected at the rate of over 150 a year. The Electricity Department has standardised on Revo models and here is one of the smaller units on its way to a new user *[Elec. Rev. photo.*

Bridlington claims to have a strong case against amalgamation or absorption, and no efforts have been spared, both in time and energy on the part of all those concerned with the future of the Bridlington undertaking to safeguard the interests of its consumers. The following particulars show the achievements and favourable position of the undertaking which maintains that no merger or amalgamation with any other undertaking would be likely to benefit its consumers.

In the first place few undertakings can boast an annual increase of about 23 per cent. in electricity sold for the past three years. Between 1934-5 and 1937-8 Bridlington's yearly sales have risen successively from 2.7 million kWh to 3.4 million kWh, 4.0 million kWh and 5.0 million kWh. In the same period the number of consumers has increased from 5,160 at March 31st, 1935, to 6,401 at March 31st, 1938, the total at present being about 6,700; ten years ago the annual consumption was only 1.7 million kWh, and the number of consumers only 2,987.

The nine sq. mile area served by the Electricity Department is almost entirely a residential one. Out of a total connected load of 16,500 kW over 14,000 kW is domestic, and no fewer than 95 per cent. of the 736 consumers per sq. mile require electricity for domestic purposes. There are practically no power consumers of any importance, the livelihood of inhabitants being dependent almost entirely on the attractions of the town as a holiday resort.

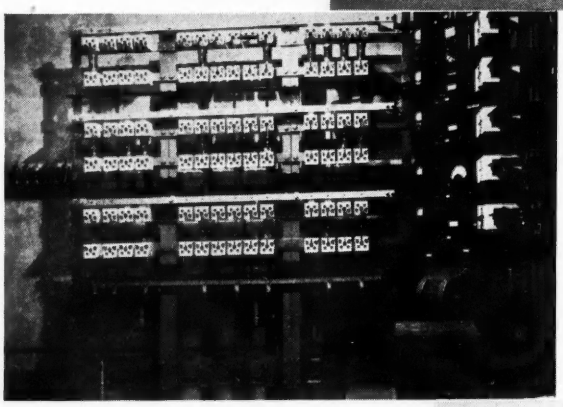
Actually in summer the population served (100,000) is nearly five times as great as in the winter (21,500), and as a result of this the undertaking has the somewhat unusual distinction, for the past five years at any rate, of recording its peak load in the summer, either in August or September. Last summer the high record of 2,590 kW was reached on September 3rd. Three years ago the highest figure attained was 1,690 kW.

The consumers obtain their supplies of energy very cheaply

and have good hire, hire-purchase and service facilities. Since 1928 the average price paid per kWh has fallen from 4.6d. to 1.96d., and recent tariff reductions included the abolition of all meter rents. The highest rate now payable for lighting is only 3½d. per kWh, and this probably accounts for what might to-day be considered the somewhat large proportion of ordinary lighting consumers (4,620 out of 6,631 at March 31st last). A two-part domestic tariff with an annual fixed charge of 15 per cent. of the rateable value (with a minimum assessment of £12 in each case) plus a "unit" charge of ½d., was introduced in April, 1937, and has already attracted some 830 consumers.

In spite of the cheapness of this rate it is still found that some of the prepayment meter lighting consumers who would like to extend their use of electricity cannot afford to take advantage of it, largely on account of having to find the fixed charge, so for these the Electricity Department offers the alternative of a ¾d. per kWh flat rate for all domestic purposes except lighting. To-day there are about 900 consumers taking advantage of the facility, and last year they consumed just over a million kWh. On all the rates mentioned as well as the business and industrial tariffs, a discount of 5 per cent. is allowed for prompt payment of accounts. About 75 per cent. of the premises in the supply area already take supplies, and in order to provide further inducements to come on to the mains an assisted wiring scheme has just been launched in conjunction with the local contractors.

The borough prides itself on its street lighting. Above is a portion of Scarborough road illuminated by 400-W "Osira" electric discharge lamps



Caravan camps provide a considerable load in the summer and at the Charity Farm site (right) about sixty cookers have been installed. Note the 11-kV catenary cable running on the same poles as the low-voltage lines *[Elec. Rev. photo.*

Though an endeavour is made, for maintenance purposes, to standardise certain types and makes of apparatus let out on hire and hire-purchase, consumers' individual preferences are always studied. Any apparatus can be hired on a 10 per cent. basis, and most of it is available also on reasonable hire-purchase terms. Strong likes and dislikes regarding appliances are very noticeable among consumers generally. It is, for instance, impossible to get a cooker out on hire without bottom heat. Consumers will not entertain side and top heat, but insist on bottom and side heat. Likewise there is no demand whatever for breakfast cookers, all consumers insisting on an open type of oven. Scaling troubles, too, due to the exceptional hardness of the water (22 deg.) practically rule out the use of enclosed type water heaters, the immersion type being preferred almost without exception.

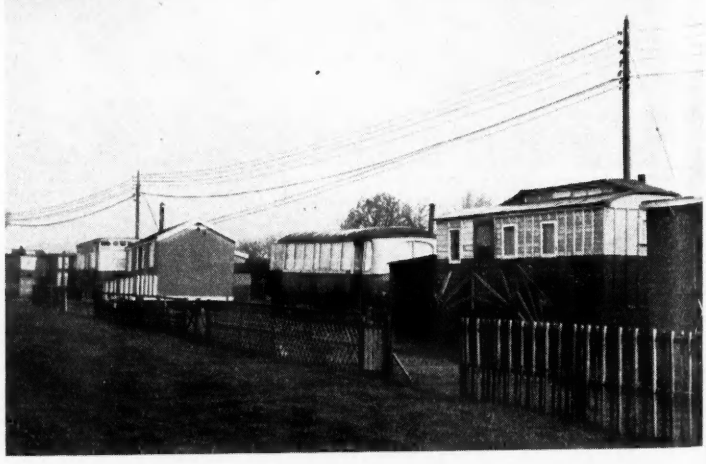
For the past few years cookers have been installed at the rate of over a hundred a year (last year it was 157), and there are now nearly a thousand in use—eight times as many as in 1926. Eight years ago the Department had not a single immersion heater connected: now it has nearly 200. Due to the large number of hotels and boarding houses it is interesting to find that washing machines installed almost exactly equal wash boilers in number, there being just over a hundred of each—twice as many as three years ago.

Hotel and boarding houses are also proving a profitable hunting ground for refrigerator sales, and account for most of the 150 or so now connected. Almost half of these have been installed since 1935, and still further acceleration of business is hoped for now that a scheme for popularising them is just beginning to show its effect. What a saving these appliances are to hotel proprietors is brought home by the boast by one owner that "he has a fortnight a year in Paris on it"!

To point out the advantages of the various appliances demonstrations are held weekly in the Department's showroom at Brett Street, while periodically special demonstrations of cooking, washing and kitchen planning are arranged at the reception room at the Town Hall which has accommodation for 500 people. Soon further facilities for demonstrations, &c., will be available when new showrooms and offices now being erected in Quay Road at a cost of £20,000 are completed.

Equipped on the most up-to-date lines, these new premises, which besides serving as showrooms will house the whole of the executive, clerical and engineering staff, will enable every type of domestic appliance to be readily displayed in appropriate surroundings. Different types of heating apparatus—radiators, convectors, panel and tubular heaters—will be installed in the various rooms, while the illumination arrangements will include a scheme in the committee room for demonstrating fluorescent lighting. One further advantage that the building will bring is that all accounts, not only electricity but rates and water, &c., will be payable in the showrooms.

The six-phase distribution arrangements at the Pier sub-station *[Elec. Rev. photo.*



Apart from the demonstrations already mentioned the Department takes part in the annual exhibitions held at the Spa Royal Hall by the Bridlington traders, and on special occasions, such as the letting of numbers of newly erected Corporation houses, &c., it is arranged for the existing staff of canvassers to be available. Weekly advertisements are inserted in a local paper which is delivered to every house in the borough, and active support is given to the British Electrical Development Association. Captain A. J. Beckett, the engineer, is, in fact, deputy chairman of its Mid-East District Committee, and his assistant, Mr. W. M. Brown, is a member of the E.D.A. Propaganda Sub-Committee for the Mid-East Area, and has acted as judge in the Area Public Speaking Competitions.

The Electricity Department takes a particular pride in its service facilities, and every precaution is taken so that consumers may not even have a chance to become disgruntled. Captain Beckett considers it money well spent to keep an engineer constantly available every day, Sundays included, up to 10 p.m. to deal with any failures of consumers' apparatus. Identical service is given to consumers owning their own appliances as to those obtaining them on hire or hire-purchase, and the resulting tendency for consumers to buy their own apparatus relieves the Department of a considerable responsibility in the matter of finance.

Non-domestic Applications

Although expansion of the undertaking depends so largely on domestic uses of electricity, the Electricity Department has not been backward in exploring other outlets for its commodity. Many buildings both public and private now have floodlighting installations, and the Corporation's own entertainment departments, which are the undertaking's largest consumers, make full use of the facilities offered devising these and other attractive schemes of illumination both interior and exterior. At Sewerby Hall, purchased by the Corporation two years ago as a public park, not only is electricity used for floodlighting the building and colour lighting the bandstand, but a special scheme of tubular heaters has been adopted for warming the aviaries.

The town's five cinemas, too, are good consumers, and the most recently erected, the "Regal," incorporates the very latest electrical features. A few farms are included in the Department's rural area at Sewerby and Marton, and some of these do their milking and sterilising electrically. The flatness of the town renders it admirably suitable for electric vehicles, and eight are now proving their worth to their users, who obtain energy for charging at ½d. per kWh. One novel use for electricity is for an electric chair hoist for an invalid.

Having had the whole of the sea front illuminated by electric discharge lighting in 1933, the town can claim to be one of the pioneers of this type of illumination. In 1936 £5,500 was spent on converting all the main roads to 400-W "Osira" electric discharge lamps, the total of which now in service numbers over two hundred. A further £5,000 is to be expended on additional improvements to the street lighting during the next few weeks, the road to Sewerby being included in the scheme, and yet another improvement scheme costing £2,800 is already planned. For the past three years all the lighting in the borough has been controlled by Strowger gear.

When the electricity supply was first inaugurated the town was small and compact, but in developing it became very spidery with long and attenuated arms stretching north, south and west. This necessitated the undertaking's changing its method of distribution, and after the passing of the 1926 Act steps were taken to change over from DC to AC. This was effected in 1932 when the works were closed down and the supply taken from the grid.

The cost of the change-over was £42,000, and while Captain Beckett does not believe in stinting money when it can be usefully employed, he devised a scheme of split-phase distribution utilising the existing three-core cables. The six-phase arrangement is, of course, only possible on account of the almost complete absence of power load, and although somewhat complicating extensions and maintenance, has proved very satisfactory. Largely on account of this device the undertaking is in the happy position of having only about £56,000 of outstanding debt, less, it is claimed, than any other undertaking of its kind in the country. Moreover, an average net profit of over £6,000 for the past five years has enabled a healthy reserve of £25,000 to be built up.

One further feature of the distribution is worthy of special mention. The Electricity Department is one of the few employing catenary cables (run on the same poles as the low-voltage lines), a four-mile stretch forming a section of an 11-kV ring main which feeds the network. The 110 miles of cables in the borough include 40 miles of street lighting cables, and in addition there are about nine miles of overhead lines supplying Marton and Sewerby. Both these villages, incidentally, are very electrically minded, and most of the premises use electricity for cooking, the consumers finding it much more economical than the paraffin employed previously. Also in this neighbourhood are several large caravan camps, one of these, we were informed, having as many as sixty cookers connected.

Gas Competition

The progress of the undertaking is all the more remarkable when the severity of the competition by the local gas company is considered. Gas costs only 7d. a therm, and any scheme brought forward by the Electricity Department has to run the gauntlet of opposition from the local Gas Company. Business is obtained purely on merit, and prospective consumers are given the full facts of the case, and in the few instances where electricity might cost them more they are told so and allowed to form their own opinions. They usually choose electricity in the end.

A good deal of the success of the undertaking, Captain Beckett considers, is due to the team spirit which he has tried to foster amongst employés, and which has led to an excellent understanding between every workman and member of the staff and himself.

Canadian Electrical News

From Our Toronto Correspondent

IN many places trams are being replaced by buses of either the trolley or the internal combustion engine-driven type, but the Toronto Transportation Commission has recently purchased 140 "street cars" of the most modern type which are a great improvement on the older cars, although the latter, in Toronto, compare very favourably with those met with in many other parts of Canada and the United States.

The new cars run on wheels which are built up with rubber between the hubs and the tyres; they both accelerate and decelerate much more quickly than the old cars and do so with great smoothness—speeding-up and slowing-down with sudden, uncomfortable jerks (a delight, one would think, of some of the drivers) cannot be done. On this continent overcrowding of the cars is tolerated to an extent that results in great discomfort to those passengers who have to stand, and it is a favourite trick of some drivers to compel such people to move to the rear of the car by starting the car very suddenly, whereupon everybody perforce stumbles one or more steps towards the rear end. After this operation has been performed three or four times, the rear end begins to fill up. The cars are entered at the front end, the exit being in the middle.

The lighting of the new cars has been greatly improved and it is now possible to look around at night without any glare in one's eyes, while the degree of illumination is as good or better than before.

In the winter in this climate heating of the cars is, of course, indispensable, but instead of having a coal stove in the cars, the new ones are heated from the motor speed-regulating resistances, the heat from which is said to be sufficient for all except very cold days, when extra current from the trolley-wire will be fed through auxiliary resistances. On mild days if there is too much heat from the motor resistances, part of the heated air is by-passed direct to the outer air; and on warm days the whole of it goes there, because the resistances are so designed as to require cooling-air at all times when they are in use. These are "one-man" cars, most of the controls being operated by the feet. Besides the ordinary wheel brakes there are two electro-magnetic track brakes, one on each side of the car.

Most of the fittings, including the window-frames and sashes, are of stainless steel, metal which has a much cleaner "feel" than aluminium. The design of practically every detail of these cars has been the subject of much research work in the United States, where the "street-railway" companies and others interested have co-operatively attempted by this means to stem the tide of competition from buses.

The Safety of Electricity

In a short talk before the Toronto Section of the American Institute of Electrical Engineers recently, some very interesting facts relating to the safety of electricity were given. In 1936 five of the largest groups of industries which collectively employed about 1,250,000 people had 622 fatal accidents, but only 4.2 per cent. of this number were due to electricity.

Between 1926 and 1935 fatalities from electric shock, per 1,000 million kWh generated fell, more or less progressively, in Canada, from 4.2 to 1.3, although there were fairly high figures of 3.8, 4.3, and 3.6 in 1929, 1930 and 1931, respectively. Actual fatalities in 1926 were 46, and in 1935 29.

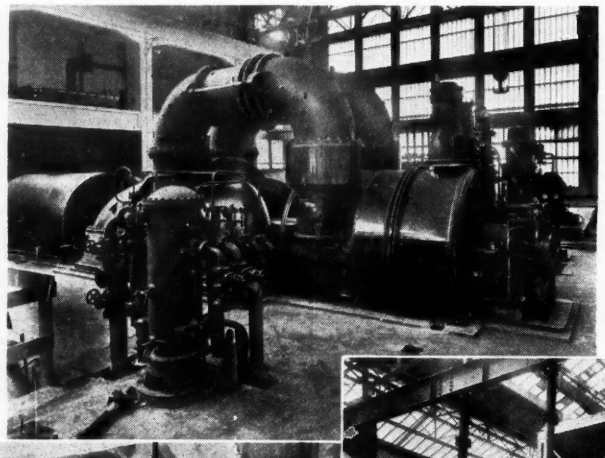
Credit is given to the Canadian Engineering Standards Association for a good share in this excellent result as this body is responsible for the issuing of the "Canadian Electrical Code" which governs the design, testing, installation and use of practically all electrical equipment with which the general public and non-electrical workmen are concerned. An interesting point is that the electricity supply authorities of Canada

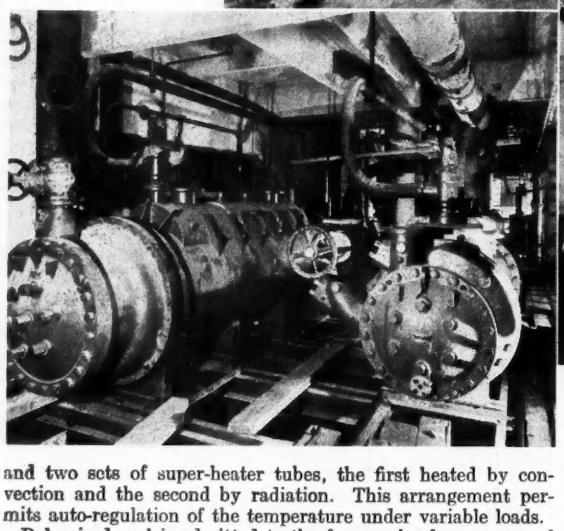
Power Station Reconstruction

Modernisation works at a Franco-Belgian frontier town

THE modernisation of the power station at Comines, on the north-east Franco-Belgian frontier, is a first step towards complete reconstruction. When the station was built in 1922 three 25,000-kW generators operated at 1,500 RPM at a steam pressure of 21 kg. (298 lb.) were installed. Later these were added to, but continued increases in the demand from the industrial region around Lille, which the plant serves, have made necessary a complete overhauling of the installation.

The new boilers are designed to produce 60 tons of steam per hour at a pressure of 711 lb. and a temperature of 887 deg. F. Two boilers are provided for the operation of one generator unit. They comprise two evaporating surfaces and two sets of super-heater tubes, the first heated by convection and the second by radiation. This arrangement permits auto-regulation of the temperature under variable loads.





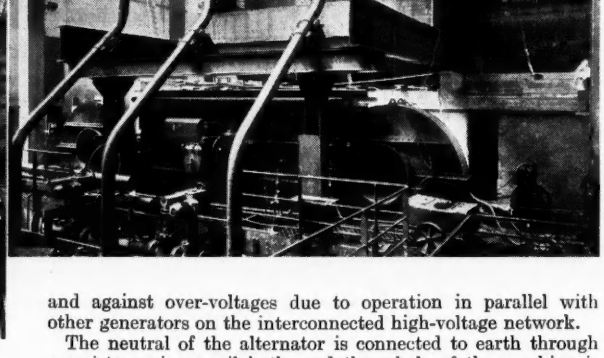
Some of the new plant at the Comines power station, showing turbo-alternator, draught fans and superheaters

Pulverised coal is admitted to the furnace by four groups of two blowers, as well as four individual heavy-oil burners, used for starting up or for operation when the load is very slack. Each draught fan can be operated by either of two motors, one at 730 RPM and absorbing 105 kW, while the other runs at 975 RPM and absorbs 210 kW. The former is used when steam production is below 56 tons per hour, while the latter serves for higher rates up to 70 tons per hour.

The new turbine, fed with steam at an effective pressure of 568 lb. and a steam temperature of 842 deg., drives a 33,000-kW 10,500-V generator with ventilating air moving in a closed circuit, and cooled by passing over cold water tubes.

The turbine has fourteen sets of blades, of which twelve are high pressure and four low pressure. The blades of the first three high-pressure stages are of chrome steel; the others are of special stainless "ATV" steel. Apart from the ordinary lubricating oil pumps, two special turbo-pumps are provided for operation during starting and stopping periods, while an electric motor pump ensures circulation of the oil after stoppage and during cooling of the turbine. The condenser is of the surface type, the tubes being divided into two groups of equal area, so that one group can be cleaned while the other remains in service.

Merz-Price differential protection covers both the generator and the step-up transformer coupled with it. Other relays guard against overstepping the maximum electrical pressure, in such a way that the time is inversely proportional to the degree of over voltage; against faults to the frame in the 10,500-V circuits; and against over-voltages due to operation in parallel with other generators on the interconnected high-voltage network.



The neutral of the alternator is connected to earth through a resistance in an oil bath, and the whole of the machine is protected against fire by an automatic carbon-dioxide installation operated by thermostats according to the temperature of the ventilating air. A special signal will give warning if the temperature of the air reaches 176 deg. F. and before the fire extinguishing apparatus is brought into action.

All the auxiliary motors of the whole installation are fed at 220 V from an independent generator group of 5,200-kW capacity, through a 10,500/220 V step-down transformer. All the auxiliary motors are three-phase, those of the draught fans being of the collector type, those of the feed pumps of the asynchronous wound rotor type, and the others of the asynchronous double-cage type. All are automatically started by contactors, and are protected by a circuit-breaker against short-circuit and has thermal overload protection.

Canadian Electrical News (*Continued from preceding page*)

pay only about one-third of the compensation rates paid by similar bodies in the United States.

Efforts are being made to ensure that children in the schools and students in the universities are taught to take reasonable care with electricity; they are also taught to realise how safe an agent it is if only proper precautions to guard against accident are taken.

Progress with regard to electricity (watt-hour) meters was recently very clearly shown by a member of the staff of the Canadian Westinghouse Co. To take two examples: A 60-A two-wire meter, and a 100-A three-wire meter. Old meters of these sizes had accuracy ranges of from 10 to 1,100 W and from 30 to 3,300 W, respectively; whereas the corresponding ranges for similar meters of modern design are from 10 to 4,000 W and 30 to 12,000 W, respectively.

The Hydro-Electric Power Commission of Ontario has recently issued bonds to the value of $12,500,000, and it is reported that $7,500,000 will be expended in Southern Ontario and $2,500,000 in Northern Ontario, on constructional work.

The success of the City of Winnipeg Hydro Electric system in building up a domestic load has been a matter of note for a good many years now. The latest figure of *average* annual domestic consumption (1937) is 4,765 kWh and the "System" is optimistic enough to think that still further increase is possible. The chief engineer attributes this result primarily to a good load-building scheme; low rates, of course, play their part, the average rate being 0.827 cent per kWh; flat-rate water-heaters (with an average rate of 0.3894 cents), the "saturation" of which is high, also had a considerable influence in procuring the excellent result mentioned.

In spite of low rates domestic bills, on account of the large consumption, are high, $58.85 being the average annual total bill. So far as domestic revenue is concerned Winnipeg is indeed a supply authority's paradise.

Measuring Instrument Progress

Observations made during a visit to the Physical Society's Exhibition

By B. S. Cohen, O.B.E., M.I.E.E., F.Inst.P.

A STUDY of the exhibits of measuring instruments at the Physical Society's annual exhibition at South Kensington last week revealed many interesting minor developments, indicating general progress in detail improvements.

The observer's eye is naturally first drawn to the general appearance of an instrument and he would immediately have noted the greater use of moulded plastics for instrument cases. Of particular interest were the tiny "Megger" testers which almost vie with the feminine powder box for compactness and gay appearance. Another example of the effective use of moulded cases is that of the Cambridge Co.'s spot galvanometer, which is a great advance both in compactness, general appearance and convenience in reading over the earlier forms of self-contained reflecting galvanometers in rectangular wooden cases.

The striking advances in permanent magnet alloys also continue to react on measuring instrument design in the direction of considerable increases in sensitivity accompanied by reductions in size. Various interesting applications of such permanent magnet alloys as "Alnico" were demonstrated, notably at Messrs. Darwin's stand, and reference may be made to the switchboard instrument of the Metropolitan-Vickers Electrical Co. with "Alnico" magnet black and stainless iron poles, also to the particularly neat "Alnico" magnets for cathode-ray tube focusing.

Negative Feed Back Amplifier

As is only to be expected, it is difficult to find any very outstanding development of fundamental importance which is likely profoundly to affect future design. The incorporation, however, of the negative feed back principle into commercial thermionic measuring instruments can perhaps well be regarded as an outstanding development, likely to lead to substantial changes in thermionic measuring instrument design.

As this principle, whilst familiar nowadays to the telecommunication engineer, who is making extensive use of it, may not perhaps be so well known to those outside telecommunication circles, a brief description may be of interest. Every radio user appreciates the large increase in sensitivity which may be attained in reception by the use of reaction (positive feed back), accompanied, however, by increased instability culminating in violent self oscillation. If, however, an amplifier with a gain of, say, 70 db (10^7 fold on an energy basis) has 30 db of the gain fed back in opposing phase (negative feed back), the result is an amplifier with a constant gain of 40 db (10^4 fold on an energy basis). The stability will be so outstanding that substantial changes in anode or filament voltage, or replacement of the valve or valves, will only produce negligible changes in the gain constancy, for example, changes of the order of 0.01 db with 10 per cent. change in anode or filament voltages.

In addition, such an amplifier will be much more immune from the effect of noise disturbance from mains supply and the level of harmonics generated will be substantially reduced so that the amplifier is capable of handling very large increases in power. The negative feed back amplifier has still another fundamental advantage. It is unnecessary for the gain in frequency characteristics to be flat before the negative feed back is applied, as the application of the latter will eliminate all irregularities. It is also quite feasible to continue positive and negative feed back in the same amplifier to enable both high gain and high stability to be attained with a small number of stages.

Those who attended the meeting of the Meter and Instrument Section of the I.E.E. on January 6th will recall the excellent demonstration of the stability of the negative feed back amplifier given by Messrs. James, Polgreen and Warren during the reading of their paper on measuring instruments incorporating thermionic valves.*

Oscillators

Although at the moment only a few commercial thermionic measuring instruments for general use incorporate the negative feed back principle, the advantages are so definite that one looks forward to a considerable increase in the number in the near future. For telecommunication purposes various transmission level meters incorporating the negative feed back principle are becoming available.

Another interesting application of the negative feed back principle is to the design of variable frequency, constant output oscillators. One such oscillator delivers a constant power of 1 mW into a load of 600 Ω resistance, at frequencies ranging from 200 to 3,000 cycles. In this instrument a gaseous discharge tube is used and this produces a limiting action on the positive feed back voltage, but is itself restrained by the use of DC negative feed back. The result is an oscillator constant within 0.1 db. for 10 per cent. changes in anode and heater supplies.

Measurement oscillators of greatly increased and wider ranges were much in evidence. These are rendered necessary by the introduction of high-frequency carrier telephony and television. Oscillators for television measurement with a range from 10 cycles to 4 Mc/s indicate the enormous band width required. The precision, uniformity and stability, together with purity of output of various commercial forms of beat frequency oscillators is quite remarkable.

Cathode-ray Oscilloscope

The cathode-ray oscilloscope is now in universal use and has displaced all other forms. So far as the writer is aware, no electromagnetic oscillographs have been shown at the Physical Societies Exhibition for several years. It is of interest, also, to note that no example of the evacuated type of cathode-ray oscillograph was on exhibit this year.

The applications of the cathode-ray oscilloscope to the investigation of short time transient phenomena and to the determination of phase angles (see Wilkinson and also Chard, Vol. 83, No. 503, of the J.I.E.E.) indicates some of the directions in which the use of this invaluable instrument may be extended and Dr. F. C. Williams and Mr. R. K. Beattie, of Manchester University, demonstrated in the research section of the Exhibition how such an oscilloscope can be utilised to permit of a number of traces to be viewed simultaneously. They make use of an intermittent amplifier and observe four separate traces simultaneously. The switching from one trace to the next is carried out thermionically. By means of a four-phase 50-cycle supply the amplifier grid is paralysed by each successive negative peak. The four separate traces follow each other at such a rate that they appear continuous by persistence of vision and by suitable phase shifts the oscilloscope could be arranged to deal with a much larger number of inputs up to the limit at which flicker would disconcert the eye.

This extremely useful method of extending the field of usefulness of the oscilloscope is one example of a trend which was much in evidence in many different directions at the exhibition, *i.e.*, the abandonment of electro-mechanical and electro-magnetic methods of switching in favour of thermionic or rectifier methods with no moving parts and no inertia to overcome. Another striking example of this is the Westinghouse lamp flasher without contacts or moving parts in which the reaction between the thermal resistance characteristics of an ordinary metal filament lamp and a simple negative impedance circuit is sufficient to maintain a low-frequency flash.

Reverting to the cathode-ray oscilloscope, it is perhaps not generally appreciated that its ease of operation and comparative robustness render it usable by unskilled operators to rapidly carry out under factory conditions such complex comparisons as the deviation in frequency response curve between a standard and production sample of telephone transmitter, &c. In one particular works I have seen an oscilloscope test outfit so arranged that telephone transmitters could be connected up in rapid succession and a steady response curve over the requisite frequency range would appear on the screen, between appropriate tolerance curves outlined in red. There should be many directions in which this method might prove of considerable value in bulk testing.

Electro-acoustic Measurement

For some years it has been the practice in electro-acoustic laboratories to plot the response characteristics of electro-acoustic apparatus and audio-frequency equipment directly on to rotating charts either photographically or by pencil tracing the movement of a spot of light from a high speed galvanometer. Such apparatus has not, it is believed, been marketed hitherto. The Marconi-Ekco Co. has now produced an "Audiograph" which automatically plots response curves by pencil trace. The "Audiograph" should prove of great value to the designer as a series of response curves can be rapidly produced showing the effects of small changes in the physical and electrical characteristics of the instrument under development. At present there is no satisfactory alternative to this "trial and error" method so far as the physical characteristics are concerned.

* See page 55.

Noise meters were exhibited by the N.P.L. and Marconi-Ekco. The former instrument, of Dr. A. H. Davies' design, gives reasonably accurate readings in phono loudness with a large range of steady, intermittent and impulsive types of noise. The Marconi-Ekco instrument is stated to be designed on the information published by Dr. Davies. An interesting feature of this instrument is the piezo-electric microphone incorporated in a non-directional housing. It is to be expected that sooner or later these objective types of air wave noise meters will be utilised as legal evidence in connection with assessment of nuisance due to noises and it will be of considerable interest to note the reaction of the legal mind to their readings.

Only one form of wave analyser was exhibited this year, and this is of a conventional type in which the components are separated in successive steps by modulating a local oscillator. It is a great pity that an instrument for wave analysis, incorporating a cathode-ray oscilloscope on the lines of a well-known German instrument, is not marketed in this country.

The latter instrument, which gives an immediate and continuous analysis in the form of a visual column graph on the cathode screen, is of such great value in so many directions that a number of investigators have been forced to import the German instrument.

Apprentices and Learners

It is very satisfactory to be able to state that the craftsmanship and draughtsmanship displayed by the learners and apprentices in both grades, *i.e.*, under 18 years of age and over 18 but under 21 years of age, has reached a phenomenally high value this year and with the great diversity in the various examples of craftsmanship submitted the examiners must have found it very difficult to assess the relative merits. An indication of the diversity of the entries may be judged by the awards of 1st and 2nd prizes.

Senior Class.—1st prize, press tool for mica by A. Kersey (G.E.C.); 2nd prize, polarimeter circle by R. C. Pedley (Hilger). *Junior Class.*—1st prize, mirror bracket by L. S. Heard (Marconi's); 2nd prize, blanking punch, die and test piece, W. H. Bone (Standard Telephones and Cables).

These awards are to be distributed by the President of the Society, Prof. Allan Ferguson, this evening at a meeting at the Imperial College, South Kensington, which will be addressed by Sir Ambrose Fleming on the subject of "Physics and Physicists of the Eighteen-seventies." Sir Ambrose and Sir Oliver Lodge are the only two surviving original members of the Physical Society of London, which was founded by Prof. Frederick Guthrie in 1874. On March 21st of that year Mr. J. A. Fleming, a young man in his early 'twenties, read the very first paper at the inaugural meeting of the Society at Guthrie's invitation. That the same individual should address the same Society after an interval of nearly 65 years must be unique in the history of scientific societies.

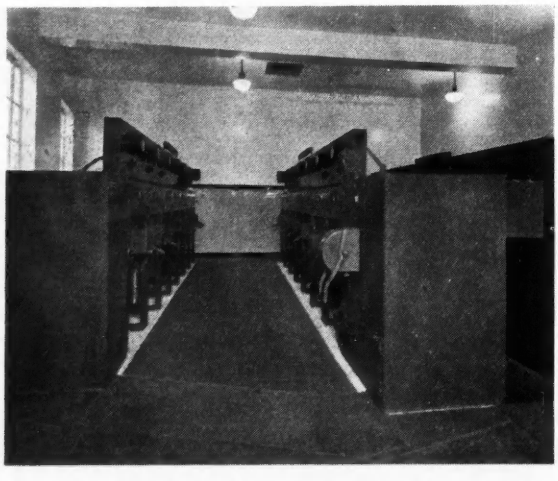
The decade which forms the subject of the address was marked by a very rapid growth of the practical applications of physical knowledge, one example amongst many being the pioneer work of Sir William Thomson (afterwards Lord Kelvin) on sensitive electrical instruments in connection with the first two transatlantic cables for telegraph communication between this country and the U.S.A. The work for which Sir Ambrose himself is best known, namely, his pioneer work on the thermionic valve used in radio telegraphy, belongs, of course, to a later period.

Redesigned Sub-station at a Glass Works

Ensuring Continuity of Supply

THE main sub-station at the Atlas Works of Forster's Glass Co., Ltd., St. Helens, Lancashire, originally contained four 500-kVA indoor transformers with high-voltage switchgear, being the property of the St. Helens Corporation, which delivered electricity by two 0.075 sq. in. feeders at 6,600 V, three-phase, 50 cycles, stepped down for distribution through the company's 400/230 V switchgear on the four-wire system.

Increasing demand caused the company, on the advice of its chief plant engineer, Mr. J. Parkin, and its consulting engineers, McLellan and Partners, to redesign the sub-station for future requirements. Owing to the continuous nature of the load, non-interruption of supply is of the first importance, and the St. Helens Corporation agreed to sectionalise its high-voltage switchboard and substitute for the existing feeders



New switchboards installed in the main sub-station at the Atlas Works of Forster's Glass Co., Ltd.

two new cables of 0.25 sq. in. section, thereby materially reducing the risk of a complete shutdown. At the same time the four small transformers were replaced by three 1,000-kVA sets with provision for a fourth to be added later if found necessary. The new ones are of outdoor type placed in open ended cells under a light roof, so that the space formerly occupied by the original transformers became available for the switchgear extensions. The high-voltage switchgear has a rupturing capacity of 150,000 kVA and comprises a bus section and summation meter panel in the centre, with one incoming feeder panel, one meter panel and two transformer panels on each side, one of the latter at present being spare.

To allow a proportion of spare capacity, fifteen low-voltage feeder panels have been installed, five to each 1,000 kVA transformer. Owing to the limited space available these are installed in three rows, each comprising the two incoming transformer panels and five feeder panels, and having its own transformer. Two bus section switches enable the three five-panel boards to be interconnected in case of emergency. Two rows of panels are placed back to back and interconnection is by trunking at bus-bar height. Connection to the third row is by cable in a trench, this arrangement allowing convenient access to all panels and ready egress at both ends of the switchboards.

Vertical isolation, Crompton Parkinson "Klad" type "A" switchgear was selected, and to maintain a uniform type of panel throughout each board the incoming supply from each transformer is brought to two 800-A panels in parallel. Suitably connected ammeters indicate the correct sharing of the load, and cable connections are made with the maximum of convenience, each circuit-breaker panel having two cable boxes. There are four cables in parallel, each four-core 0.3 sq. in. section, this size being easy to handle. If necessary one circuit-breaker can be isolated for repair and up to 800 A provided by the other.

Overload series trips with adjustable time lags in the oil tanks are provided on all low-voltage feeder and transformer panels. The current settings and time lags of the outgoing circuits are calibrated in relation to the incoming units, and the settings on the incoming units are in turn correlated to the protection on the high-voltage switchgear. The latter comprises "P.B." relays on the transformer panels and reverse current protection for incoming supplies designed to isolate a faulty feeder only.

To minimise the risk of fire spreading an oil drain is provided under each switch tank and precautions have been taken to keep oil from cable trenches, some of which are filled with pebbles or sand. A large oil drainage trench is also provided in front of the three transformers. So far as is known this is the only sub-station of its kind in which "Vitrolite," manufactured by Pilkington Brothers, Ltd., has been used for wall lining.

The high-voltage side of the installation, switchgear and transformers was carried out by the St. Helens Corporation Electricity Department. The change-over of the low-voltage distribution from the original switchboards to the three new boards placed at right angles to the former direction was carried out by Forster's Glass Co.'s own electrical staff. This complicated change-over was carried through without any stoppage of electrical supply.

Boiler Make-up Water. By F. Kenyon, A.I.C.

In the following article the author deals with the pre-treatment of make-up water and sampling during steaming and non-steaming conditions.

MAKE-UP water for industrial steam raising plants, whether the percentage requirements be large or small, is of considerable importance to the ultimate efficient running of the plant. Even where the make-up water is to enter the boiler feed system entirely untreated, a knowledge of its characteristics will often help considerably in operating the plant. When pretreatment in the form of softening and/or evaporating is contemplated, this knowledge is of even greater importance. In boiler plants other than water-tube units, little or no treatment is often prescribed, and sometimes scale sooner or later develops.

Boiler fluids or compounds may be quite excellent in their particular sphere, especially when used at the right time, but when the amount of scale is large this treatment often fails, particularly when no account is taken of the chemical composition of the scale. This problem of removing scale from boiler shells is rather beside the point of preventing its formation, which can be effected quite easily. A knowledge of the soluble material dissolved in the make-up water is the first step in the right direction, and from this information suitable treatment can be arrived at. Simple and inexpensive methods are available which can be operated by the boiler house staff. In addition to scale prevention, parallel treatment could be adopted whereby corrosion of feed lines, economisers, &c., would be minimised. The boiler steam would also be free from carbon dioxide, which is often the cause of corrosion where the steam is used for process work or heating and returned as condensate.

Chemical Sludge Formation

The addition of chemicals to either the feed water or to the boiler itself, with a view to scale prevention, will result in sludge being formed in the boiler. Excessive blowing down may therefore result if the percentage make-up water is high. As the quantity of scale-forming salts present in the make-up water also has some bearing on this point some type of treatment of the make-up water, before it enters the feed system, might be practicable. An investigation of the character of the water carried out before the design of the plant for the supply of feed make-up is complete is often well worth the small effort and expenditure involved.

Valuable data, in the form of chemical analyses, may be available either from the water supply or the river authorities. This information would probably not be complete in itself, but it might be a guide to periodic and seasonal fluctuations in the character of the water concerned. Further details should therefore be obtained, and samples of water, taken at intervals during twenty-four hour periods, collected and tested. Very considerable fluctuations in the amount of dissolved matter contained in a supply water have been known to occur during such a period and it is not good enough to take samples at approximately the same time daily. It is these comparatively rapid variations in the character of a water which materially upset the operating conditions and the causes are sometimes only realised when it is difficult or too late to counteract them effectively. Seasonal variations in the character of a water supply, while important, are not so vital as rapid fluctuations, and in any case probably take place comparatively slowly. Where the water is to be obtained from a tidal river samples of water should be taken at various states of the tide.

Free Carbon Dioxide

Evaporators are sometimes installed to provide so-called distilled water for boiler make-up. Difficulties then occur due to the character of the initial make-up water supply. A water containing appreciable amounts of bicarbonate of calcium or magnesium would produce a distinctly acid distilled water from an evaporator other than one of a low-pressure type. The acidity may cause corrosion of heater tubes, and of the fresh-water side of the evaporator condensing system.

This acidity would be due to free carbon dioxide, and from a raw-water supply containing about twenty grains per gallon of bicarbonate hardness, the distilled water would contain amounts of this gas in solution varying between two and ten grains per gallon. The pH range of this distilled water would be low, and its corrosive tendencies towards copper, brass and mild steel would be relatively high. If such an acid water entered a boiler feed system without further treatment, the latter would become acid, with resultant risks to feed lines, economisers, &c. The steam from the boiler would also be acid, with probable further corrosion troubles elsewhere.

Corrosion in the feed system from this type of feed water could be checked by the addition of caustic soda, which would also help to protect the boiler generally. Water-line action in the latter, however, may result if the boiler pressure is above 250 lb. per sq. in., and if oxygen is present in the feed water. Steam at that pressure would also contain carbon dioxide. The latter gas would still be contaminating the evaporator condensing system, and the only cure would be either to pass the evaporated water through an efficient de-aerator, or to treat the make-up water chemically before it is evaporated.

Ammonia and its Effects

Another gas frequently found in make-up water is ammonia, and while this is sometimes welcomed as a constituent of feed water, it often causes concern to the feed-water chemist. Ammonia is not often found in or liberated from supply waters in troublesome quantities, but river waters may present a different front. Even comparatively deep well water has been known to have an ammonia content by no means negligible. It is doubtful, however, if this ammonia would make its presence felt in any steam system which did not include evaporators.

The ammonia content of the distilled water from such a system would depend not only upon the organic matter and ammonia contents of the initial water supply, but also upon the working pressure of the evaporators. Ammonia gas is very soluble in water and is extremely difficult, if not impossible commercially, to remove completely. Evaporated water containing ammonia gas in solution would spread throughout the whole boiler feed water and steam systems.

In the evaporator condensing and boiler feed-water systems ammonia may not cause much harm; in fact it may help in keeping corrosion in check, because it would suppress the hydrogen-ion concentration in the water. My own experience is that ammonia in the steam systems of medium- and high-pressure boiler plant is not harmful, but caution may be necessary in ultra-high-pressure systems. In power plant practice the air pump attached to the turbine condensing plant has to withstand relatively high concentrations of gases and ammonia and carbon dioxide can cause corrosive havoc unless care is given to the choice of materials used in its construction.

Sampling Under Steaming Conditions

Where feed-water and water conditioning is in operation the withdrawal of a reasonably representative water sample while the boiler is on load is a necessity. The information obtained from testing these samples in the laboratory will show how the internal treatment of the boiler unit is progressing, and also give some idea of the blowing-down frequency. Difficulties are, however, often encountered in sampling under steaming conditions.

With Lancashire boilers it will usually suffice to take a sample from the lower cock on a gauge-glass fitting, care being taken to close the upper cock while doing so, and also to prevent undue flashing of the water into steam. The water level should be kept at the same height during sampling. In the case of water-tube boilers, samples should be taken, if possible, from two or three points under both steaming and non-steaming conditions. The latter should preferably be about one hour after the boiler has come off the line and with a normal water level showing in the gauge-glass. Considerable circulation will have taken place during the hour, and it is almost certain that these samples will show similar concentrations of dissolved solids when tested.

In many plants, sampling under non-steaming conditions is the only one which gives similar samples from different points of the unit. If the water samples taken from the same points under steaming conditions vary from each other and also from the non-steaming ones, further samples should be taken. In fact, the whole series should be repeated several times, and when the results are tabulated it will be found that certain samples will have an approximately constant ratio towards one another. In this way some information will be gained as to what is happening inside the boiler, and this will help in deciding the one point from which routine samples of water should be obtained during steaming conditions.

With the same water level and perfect circulation the steaming sample should be more concentrated than the non-steaming one. This, however, does not always happen in practice, and a little research on this problem will be time well spent, and it will definitely give one a datum on which to work. An illustration of this sampling bogey will perhaps help one to appreciate the difficulties sometimes presented in conditioning

a modern single-drum water-tube boiler. The weight of hot water contained in a boiler with half a gauge-glass reading was fairly accurately known, and an amount of caustic soda to give 10 grains per gallon was added.

After steaming several days and while still on load a sample of water, taken with the usual precautions, was obtained from the north end of the mud box. Analysis of the sample gave a concentration of approximately 2 grains per gallon of caustic soda, and a sample taken from the south end of the mud box gave similar results. Further samples from both points gave concentrations varying between one-third and one-fifth of the theoretical, while samples obtained from exactly the same positions during non-steaming periods showed the expected concentration of approximately 10 grains per gallon. This series of operations was repeated on several other units, yielding exactly the same information. Samples of water were then obtained under normal load conditions from the steam drum of one of the units. The diameter of the drum was 4 ft. and three points were chosen, one in the middle and the other two at 3 ft. from each end, while all three points were 1 ft. from the bottom of the drum. It was found that each point always gave its own particular concentration of caustic soda and that the concentrations at the three points varied between that at the mud box (2 to 3 grains per gal.) and the theoretical amount of 10 grains per gallon, averaging about 5 grains per gallon. Under non-steaming conditions the three drum and the two mud box samples all gave concentrations of approximately 10 grains per gal.

Confirmation was obtained by repeating the experiment on another unit. All the steam drum samples were obtained by the use of efficient coil condensers. These boilers, by the way, were equipped with steaming economisers from which the feed water entered along the middle portion of the drum.

Where to Obtain Samples

From which part of a boiler should a sample of water be obtained, for conditioning control purposes, when faced with a problem similar to the above? In the case cited this was taken from the mud box, with the definite knowledge that the concentrations thus obtained were from one-fifth to one-third of those under non-steaming conditions. This state of affairs is not at all satisfactory from a feed water chemist's point of view, because he has to take care of boiler units which are virtually divided into a number of sections. A reply to this may be that it is only necessary to keep the boiler section of lowest concentration sufficiently protected by chemicals to ensure a reasonable safeguard against corrosion and scale deposition. There are, however, serious objections to such a scheme, and these will be discussed in a later article.

It is also suggested that water samples should be taken from a boiler with respect to any alternative method of feeding which may be in use from time to time. Although a feed trough inside a boiler steam drum is supposed to distribute the incoming feed water evenly along the length of the drum, it does not always do so. There may be a feed-valve delivery at each end of the trough, one being changed over to the other on alternate days or weeks. These are the periods during which discrepancies in the water samples may be expected, and further investigation should be made. As an example, during a series of tests a sample of water was taken every day from the same blow-down point on a water-walled pulverised-fuel boiler. The concentrations of chemicals in the samples remained more or less constant until one day they fell to between one-third and one-half of those obtained previously. They continued at this low level until the same day of the next week, when the concentrations rose to their previous high level. Daily sampling, continued for a month, confirmed that the concentrations were steady but low one week and steady but high the following week. The boiler was steaming continuously during the whole of this period, and the water samples were taken when the unit was on normal load.

Effects of "Streaky" Circulation

It was subsequently ascertained that the "north" feed-water check valve was in operation one week and the "south" check the following week, and that the change-over was always made on the same day of the week. Further experiments showed that the whole of the water at the "south" end of the boiler was low in chemical concentration when the "south" feed check valve was in use, and vice versa. Since there appeared to be good agreement between the waters at all the sampling positions at any one end of the unit it was decided that for routine testing it would be good practice to obtain a mixture of equal amounts for similar positions at the two ends of the boiler. This proved to be the case, and the conditioning of these units relative to scale and corrosion prevention proceeded satisfactorily for a number of years. Thus streaky circulation of the feed water inside the boiler can make it difficult to obtain a useful sample of the boiler water.

Where the practice is to pump conditioning chemicals into steaming boilers it may be as well to pump half into each end of the unit. Several instances are on record where chemicals have been pumped into one end of a boiler unit and remained more or less concentrated at that end for a considerable number of hours.

When it is known that a boiler is coming out of service for several days a good practice is to take a sample of the boiler water some time before it is taken off load. When the boiler is cold take another water sample and compare the analyses of the two. If there is any calcium sulphate scale present in the boiler this material will show itself in the cold boiler water sample but not in the one taken whilst the boiler was steaming. Water obtained from a steaming boiler unit, therefore, may not give all the information required for satisfactory conditioning. Even in water-tube units and where some type of phosphate conditioning is in operation, if a boiler water does not show the presence of phosphate in solution, it should be tested for calcium sulphate. Should the latter be present, addition of phosphate would probably result in this chemical being used up quickly, because it would attack and gradually dissolve the sulphate scale.

The point is that while it may be known that a unit requires phosphate addition, it is not always appreciated why this chemical may vanish so rapidly from a boiler water. As the dissolution of sulphate scale by sodium phosphate results in an increase in the concentration of sodium sulphate in the boiler water, this sometimes gives a clue of what has been taking place. It is also a good policy to examine visually a water sample taken from a boiler. Shake a portion of the water in a bottle and note if there is any tendency to froth, as oil and grease do find their way to boilers and cause priming as well as other troubles. Take a note also of the suspended matter in the water, as examination and/or analysis of this is quite often of benefit. The systematic taking and testing of boiler water samples, therefore, often yields information which is of real value in the operation of boiler plant and in maintaining continuity of service.

Pole Setting Machine

ATTEMPTS to mechanise the erection of wood poles for carrying overhead electric lines are periodically made in the United States. The combination of a power-driven earth-boring device and jib crane with a Diesel driven caterpillar tractor made by the Highway Trailer Co., Edgerton, Wisc, U.S.A., is claimed to have enabled the work of pole setting

Lowering a pole into the hole dug by the auger

for overhead transmission lines to be greatly accelerated with considerably reduced labour charges. The accompanying illustration shows a tractor completely equipped for this work, the auger being suitable for sinking holes up to 10 ft. deep if necessary, and the jib crane for dealing with poles weighing up to about 22 cwt. When in charge of two men, such an outfit is capable of sinking holes and setting the poles at the rate of 100 per eight-hour day. A somewhat similar outfit, mounted on, and driven by the engine of, a lorry and made by the Four Wheel Drive Auto Co., Clintonville, Wisc., U.S.A., was illustrated in our issue of August 21st, 1936, p. 258.

Organisations of the Industry—IV

The E.C.A. of Scotland

By Walter Finlay, W.S.

THE Electrical Contractors' Association of Scotland, while it may be, owing to its being confined to Scotland, one of the smaller bodies of the industry, is in point of fact, one of the oldest electrical trade associations as it was originally founded in Glasgow in the latter part of the year 1900. The first chairman was that hardy old pioneer of electricity in Scotland, Mr. Thomas Wright, of the well-known firm of Anderson & Munro, Glasgow, who ultimately was the third president of the E.C.A. Incorporated, the united association for Great Britain, during the year 1906/07.

An article on the Electrical Contractors' Association appeared in our Dec. 30th issue. The present one, dealing with an Association which was once actually a part of the E.C.A., completes the story of contractor organisation in Great Britain.

The Glasgow contractors at the foundation of the Association realised there was a clamant necessity for organisation in order to settle uniform rules to regulate the relations between employers and employés and also with corporations, manufacturers and architects. They accordingly resolved that an association should be formed at once and twenty-five members were enrolled as a result of a preliminary canvass by the late Mr. R. D. Cassells. Even at that date the question of registration was put in the forefront of the programme of the newly formed Association. Had state registration then been introduced one wonders if the use of electricity would not have been substantially stimulated and the class of work immensely improved to the credit of the industry and the permanent advantage of the consumer. The Association has always supported the present voluntary Register and is taking part in the recently formed conference in support of compulsory registration.

Mr. R. Kilpatrick and Mr. H. M. Speirs, B.Sc., are president and vice-president of the E.C.A. of Scotland

In April, 1904, at the suggestion of the Glasgow Association, a meeting was held in Edinburgh and immediate steps were taken for the formation of a local branch in the capital city. As just at this time the Electrical Contractors' Association was initiated in London, the Scottish organisation agreed to amalgamate with that body in one association for the whole country with a Scottish Section operating in Glasgow and Edinburgh. In 1907 the activities of the Association were extended to Dundee, where a branch was formed and a few years later another branch was set up in Aberdeen.

The Scottish Organisation

The Scottish Section operated as a part of the national body until November, 1911, when, for convenience of administration and in order to deal specially with many features which were peculiar to northern conditions, the Scottish members deemed it advisable to recast the Scottish membership into a separate entity and the Electrical Contractors' Association of Scotland, as now existing, was formed. At the same time it was agreed to work on all common questions in cordial conjunction with the English Association, and that course has been followed ever since.

The organisation of the Scottish Association operates through four main territorial branches :—Glasgow, Edinburgh, Dundee and Aberdeen, and sub-branches of these centres have been formed throughout the country as necessity has arisen, more particularly in view of the extension of the areas of supply by the construction of the grid. All local electrical affairs are dealt with by these branches and the governing body of the Association is a Central Board with central officials. This Board meets monthly, usually alternately in Glasgow and Edinburgh, and is composed of representatives elected by branches. It deals with the innumerable problems which are of mutual interest to contractors in Scotland such as relationships with supply authorities, conditions of trading with manufacturers and distributors, and labour problems involving working rules, wages and the numerous issues that arise therefrom.

For many years different standard rates of wages prevailed throughout Scotland and before the War the standard rate of wages was discussed and adjusted locally. It was agreed by both sides that this created an anomalous position and ultimately it was arranged that there should be one standard rate throughout the whole of Scotland. A rate was settled, and ever since, as necessity arose, the position has been discussed between the Association, as representing the employers, and the Electrical Trades Union, as representing the employés, and satisfactory agreement generally has been reached. There is no automatic sliding scale in Scotland; the rate has always been fixed by joint conference after all the relevant factors have been considered.

In addition to adjusting the usual trade agreements in the interests of its members, the Association has negotiated many favourable arrangements, such as insurance schemes dealing with Workmen's Compensation and third-party liability, and all members are provided with a confidential jobbing price list on the loose-leaf system which is kept up to date by the issue of new pages as may be required owing to substantial variations in the prices of materials or rate of wages.

The Social Side

The Association has taken a leading part in the formation of local electrical societies which have provided a meeting place for all concerned in the industry. The winter social gatherings, which take the form of a dinner-dance at each of the four branches, are looked forward to as the electrical social functions of the year. A summer conference open to all is not promoted but members and their ladies meet each year for a week-end gathering at an attractive centre when the annual business meeting of the Association is held. Golf matches, bowling matches and angling contests are also arranged.

The contractors' conference at the Empire Exhibition last year was a great success and it is hoped the membership will be considerably added to as a result.

The "Scottish Mode"

Early in 1915 a conference of architects, surveyors and representatives of all sections of the building industry in Scotland was called under the chairmanship of Sir George Askwith at which also representatives of Government Departments were present and it was resolved that a national code for building works in Scotland should be established. Representatives of the Electrical Contractors' Association of Scotland took a prominent part in this movement. After a prolonged series of meetings a Scottish Mode of Measurement, containing both general and particular regulations appropriate

[Lafayette

Mr. W. Finlay, the author of this article, is consultant and solicitor to the Association. His son, Mr. M. P. Finlay, W.S. (right), succeeded him as secretary last year

CORRESPONDENCE

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

Electricity on the Farm

MAY I thank Mr. Frank Ayton for the attention he gave in your issue of January 6th to the footnote on page 796 of the ELECTRICAL REVIEW for December 2nd, and express the hope that the I.E.E. *Journal* will copy his example.

In my letter on December 2nd, I contrasted the small capital cost of a three-phase line on the farm at Mungoswells, Drem, with the high figure given as the cost of one mile of three-phase 6.6-kV line to a 50-acre holding where I want electricity for what appeals to Mr. Ayton, *i.e.*, not ploughing, but barn machinery, pumping, &c. If only 50 kWh (the minimum) were the average consumption in the first year, the return would be equal to 3 per cent. (this being the rate paid by the authorised undertaking on its loan), but I am asked to guarantee 20 per cent. on £600, while the supplier is legally protected and the prospective consumer is completely ignored.

Should not the local authority which, nine years ago, consented to the monopoly of electricity supply in its area have insisted upon the statutory condition that supply should be given within a reasonable time, in the interests of the sixteen electors and potential consumers mentioned in my previous letter? THEODORE STEVENS.

Herne Bay, *January 6th.*

Tendering Conditions

Referring to Mr. Cook's letter under the above heading in the ELECTRICAL REVIEW of December 30th, my own firm does its utmost to meet the varying conditions laid down by inquirers in their specifications. One concern must have the tender made out as a pro forma invoice. In another case a special type of fuse must always be included and still another must have 10 per cent. cover shown in a separate letter. One firm insists that a certain class of motor shall not be fitted with a fan whilst another must have all starters rated for heavy duty irrespective of the service. These idiosyncrasies are not always specified by the inquirer who, when taken to task, merely replies, "You know my standard requirements."

Not all the foregoing applies to corporation inquiries and tenders, but the plain envelope requirement is one that can very easily be overlooked, since the engineer who compiles the tender does not usually post it. In one case this special requirement was complied with and the envelope properly addressed and endorsed (by the estimating engineer himself), but it had to be sealed, and the girl in the mailing department used a metal stamp bearing the firm's name to press down the sealing wax—result, disqualified tender, though why this should disqualify it passes all ordinary understanding.

Inquirers should try to realise that there are numerous other inquiries to be gone into as well as their own particular one, and ordinary mortals cannot remember individual special requirements. Valuable time can be taken up ascertaining whether or not this or that customer has any special requirements. A capable estimating engineer will read through the specification as soon as possible after its receipt (and in this connection he cannot always drop everything and divert all his attention immediately to the newly received inquiry) making notes of special points to be taken care of. It may have to be passed on the design and drawing offices; one or two other departments may be concerned as well, so that the specification will have to be copied unless the inquirer will let the tenderer have a few more copies of the specification. Usually further copies can be obtained for a non-returnable fee, but a firm regularly quoting to such inquiries could spend a considerable sum of money in a year in this way. Public bodies should be generous on this point and rely upon the integrity of the manufacturers with whom they deal not to misuse the specifications.

After getting various departments moving, the estimating engineer goes back to the job he was previously engaged upon (possibly some other corporation inquiry!). As the posting day approaches the estimating engineer chases the people who are holding up the tender, but it is always likely that he will not receive final information until the afternoon of the day on which the tender is due for posting. He has then no time to read through the specification again, but will take a hurried glance at his original notes. Nevertheless, he will be so anxious to get the tender right from the technical and commercial aspects that the grand finale (the envelopes!) will be overlooked.

If corporations have special mailing instructions I would suggest that they issue an envelope with their inquiry as most Government Departments do, but please let it be big enough to hold all the literature and drawings asked for.

Manchester, *January 4th.* WILLIAM ANDREWS.

High-rupturing-capacity Fuses

With the growing demand for high-rupturing-capacity fuses, more and more manufacturers are entering this market, and many consultants and supply undertakings are now specifying this type of fuse. This has been brought about by the growth of the grid scheme during the last few years.

Where a factory is situated near one of the large power stations feeding the grid, very large short-circuit values may be obtained, and it is therefore desirable to install a fuse which is capable of dealing with them without damage to the switchgear on the system.

Owing to the speed with which h.r.c. fuses will clear a

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to each trade, was agreed upon, and it is generally held that that mode has been of the greatest benefit to the industry by co-ordinating together what had up to then, in many cases, been somewhat indefinite rules. For most important contracts in Scotland this mode is now the governing condition. The mode has stood the test of time well as it is only within the last few years that steps have been taken to revise it and bring it up to date in view of twenty years' experience of working.

Fair Trading

Shortly after the War the Board of the Association came to the conclusion that an endeavour should be made to define and record in a concrete form what should be the proper relationship of all those who served the installation industry, manufacturers, wholesalers and contractors, and a committee was appointed to explore the subject. Ultimately, definite proposals were agreed upon and a conference of those intrested in the subject in Scotland was called in July, 1925, when a simple Fair Trading Agreement was submitted and approved. This agreement was signed on behalf of the Association and by practically all the local wholesalers and manufacturers but the larger manufacturers who were concerned in the industry throughout the United Kingdom found difficulty in consenting to an agreement which would only operate in one locality. Ultimately, at the conference which followed on the passing of the Electricity Act of 1926, reference was made to the Scottish agreement by the municipal representatives at that conference who had not realised that the agreement had been framed long before the passing of the Act and the conference came to the conclusion that the proposals were worthy of detailed consideration with a view to some national scheme being prepared. The outcome of this decision was Committee "D," from which ultimately emerged the Fair Trading Council and Policy. The Association has always felt that Scottish supply authorities, both municipal and company, would have been willing to co-operate in the working of such a policy for Scotland and that, consequently, complete unity would be obtained.

Technical Training

From the earliest days of the Association every endeavour has been made to encourage members to take particular interest in the technical training of their apprentices with a view to having the highest standard of labour available. Technical installation classes for apprentices are carried on in all the chief centres in conjunction with the education authorities and representatives of the Association's branches take a leading part in the direction of these classes and prizes are provided by the Association's branches for the best students.

The Association has always aimed at a reasonably high standard of technical qualification for its members or the technical manager of any firm or company desiring to become a member. At the same time it has been realised that many contracting businesses start in a humble way and the Association has encouraged the founders of new businesses to join the Association early as the view is that only by belonging to such an organisation can a new contractor carry on his business on sound lines.

fault (and tests have proved that they will operate even quicker than a circuit-breaker), it is necessary, if h.r.c. fuses are installed at all, to fit them throughout the whole installation, because a fault on a sub-circuit controlled by a rewireable fuse would blow the h.r.c. fuse before it had been cleared by the fuse on the sub-circuit. Owing to the high cost of the h.r.c. fuse compared with that of the rewireable fuse, the equipment of a large factory with the former is costly.

My personal opinion is that it is a debatable point if these fuses are always absolutely necessary. B.S.S. No. 88 and the I.E.E. Regulations (No. 1333) for rewireable fuses give certain figures for fusing and rupturing capacity, but at least one low-voltage switchgear manufacturing company gives results of tests carried out by an independent authority showing figures well in excess of that required. For instance, a 15-A 500-V fuse, under the I.E.E. Regulations, should have a rupturing capacity of 1,500 A on 260 V, whereas the fuse in question cleared 9,000 A on 250 V. The B.S.S. requirements for h.r.c. fuses are 16,000 and 33,000 A at 250 V; but are such values necessary in many cases?

The h.r.c. fuse has many advantages, but unless its cost can be considerably reduced I do not see how it can be used on anything like the same scale as the rewireable fuse. During a recent tour of the Continent, where the h.r.c. fuse is the only type in use, I purchased a spare 5-A fuse for 5 pf. in Germany, which, at the present rate of exchange, is less than a penny. I do not say that the fuse would stand up to a test to meet our requirements, but unless we can get down to a really low price for spare fuses I cannot see that we will ever change over to h.r.c. fuses for domestic use.

One of the difficulties of the manufacturer is the cost of development. There are only about four or five firms in this country who have the necessary equipment to test fuses for 33,000 A, and they would not be anxious to test fuses for firms who may be competitors at some later date. There are firms on the Continent who could carry out such tests, but it seems a pity that manufacturers should be compelled to go abroad for this purpose. The cost of putting down a plant to test fuses is prohibitive, unless other tests have to be carried out on the firm's products. Even so, I understand that the approximate cost of each test on one size of fuse is about £200, and the consequent high development charges have presumably to be recovered in due course in the selling price of the finished article. CONTACT.

January 7th.

Engineers and Public Speaking

I have attended many I.E.E. meetings at various Centres throughout the country and have been astonished at the inability of otherwise competent engineers to make any shape at extempore speaking. One can forgive a man interspersing a few "ers," "ands" and "buts" and the like, but one cannot forgive the utter nonsense which is often spoken by the older members at such meetings. They, of all people, ought to be able to marshal their thoughts in a lucid and coherent manner, but they do not. Further, no matter what the subject is they seem to think it is expected of them to rise and speak. In these days of specialisation it is impossible for a man to be thoroughly acquainted with more than one or two aspects of electrical engineering. True, he may have a superficial knowledge of the subject but one goes to the I.E.E. meetings to hear a paper by an acknowledged expert and some relevant discussion and pertinent questions.

Manchester is reckoned by many to be the best centre for apprehending electrical engineering subjects and the other evening I attended an I.E.E. meeting. The paper was excellent, and the author had made a synopsis of the paper to read to the audience. I settled down to enjoy a good discussion, instead of which the speakers proceeded to go through the paper page by page and extemporise remarks. Some were so frank as to say that they had never read the paper before they came to the meeting; surely they should not stand up and talk without having previously given the matter careful study.

On many occasions I have been bored by the long pointless lectures which various speakers have given as their contributions to discussions. Every one who is going to take part in a discussion should at least procure a copy of the paper beforehand and arrange his remarks or take a course in public speaking. Also, he should be limited to a certain time.

There is usually more life and verve in the meetings sponsored by the I.E.E. students. Many of my colleagues state that it is a sheer waste of time to attend I.E.E. meetings as the older members usually monopolise the discussion time and say nothing. We are taught to respect our elders but how can we on the showing they make at technical meetings? They ought to ask their questions and sit down again, leaving the bouquets and thanks to be offered by the proper persons.

Northwich, *January 6th.* D. MACLAREN CATHCART.

Here and There

By Nomad

SOME interestings things pertaining to the price and quality of electrical apparatus were said recently in the correspondence columns of the ELECTRICAL REVIEW under the heading of "Cheapness and Reliability," and I must close with Mr. R. Wall over his statement about the popularity of electric cookers being shown by the great increase in the numbers installed in recent years. Mere figures of increase do not tell the story; it is the relation between increases in electric and other cookers that counts.

* * *

In some of our big towns and cities I have been shown some very impressive figures depicting the increase of electric cookers installed from year to year, but the answer to my question "What has been the increase in the number of competitors' cookers installed?" has been "Hush! hush! !" I have been taken to task for raising this point before, on the grounds that it is not in the electrical industry's interest to do so. It is because I so heartily agree with Mr. Wall that the electric cooker gives superior performance that I insist that bringing the true facts to light is the proper thing to do. The industry will not completely succeed in its task of "educating the public" until all sections within it submit to being educated.

* * *

It is something rather new to see the charge of advocating lower-quality cookers levelled against a supply man, if that is what is implied by Mr. Alex Milne's remark that electrical apparatus should be built up to a standard rather than down to a price. I have had a good deal to do with cooker manufacturers for some years and I have yet to hear a complaint from them to the effect that the supply man wants lower quality. On the other hand, I have been told many a time that if only the supply engineer would accept a little less sturdy construction the price difficulty, with particular reference to the economics of hiring cookers, could be more easily solved. In saying the time has arrived for mass production I wonder if Mr. Fennell means standardisation, for I have seen some excellent examples of mass production of cookers in this country, each factory being concerned only with its own particular design, of course. Well, we have had one "standard" cooker and I hope that before the next experiment is tried the industry will be able to say—"This time we are ready for it."

* * *

In a large stores in Birmingham I recently saw some electric single-bar fires marked "750 W, British made" for sale normally at 2s. 11d. each. A cursory examination did not reveal anything electrically wrong with them and I had to admit that if I were not electrically minded and had a use for a small fire I would probably have bought one. I cannot possibly understand how an electrically and mechanically sound fire can be made for sale at 2s. 11d. On the other hand, I cannot accept the general idea that a low-priced appliance must necessarily be "shoddy." The point I want to make, however, is how are the public, the non-electrical dealer and, indeed, the electrical man without facilities for adequate testing to know what is electrically sound?

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I do not for one moment suggest that all is well in the appliance market, and I know that in far too many cases cheapness does mean unreliability. The question is, however, as Mr. Walter Riggs, president E.C.A., put it to me recently, how are we going to "stop the rot"? He does not think that the proving house idea would fit in with the present organisation of the industry, and he suggests that licensing the retailer, both electrical and non-electrical, would be more likely to produce the desired results, coupled, of course, with "educating the public." I agree with Mr. Duckworth, of Croydon, that it is up to someone to make it clear to the retailer that he is as responsible to his purchaser who suffers injury as the result of using shoddy apparatus sold to him as is the grocer to his purchaser of tainted potted meat who is poisoned as the result of consuming it.

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A representative of a large supply undertaking told me that it was difficult for the supply man to take a hand in the shoddy apparatus problem because of the risk of giving the public the impression that electricity is unsafe. I hope that most undertakings will disagree with this view because any "electrical accident" does more to create such an impression than sound advice. The supply, manufacturing and contracting sections of the industry should all take a hand and, where necessary, submit to "education." Further, our propagandists should exert their energies in the required direction.

Meetings and Discussions

Opinions on Water Heating Valve Electrometer Principles Energy Comparisons

The interest that is at present being taken in developing the domestic water heating load was clearly shown by the discussion on Mr. J. I. Bernard's I.E.E. paper last week, although one speaker thought that cooking was a better load and room heating more valuable than either. Other subjects discussed have included the characteristics of valve-type electrometers and an interesting method of analysing the merits of different sources of energy.

Domestic Water Heaters

THE statement of the present position, scope and trend of design of domestic electric water heaters in this country as set out in Mr. J. I. Bernard's paper (to which reference was made last week) was discussed at a well-attended meeting of the INSTITUTION OF ELECTRICAL ENGINEERS in London on January 5th.

Mr. A. E. McKenzie opened the debate by remarking that he had been associated with the author for many years on both the E.D.A. and the B.S.I. Water Heating Committee. Sixteen years ago there were very few electric water heaters and those then in use were of the constant trickle type with low loading. Several hundred of that type had been installed in Wimbledon. The B.S.I. specification would ensure the provision of still better types than those at present available. It was desirable to consider whether the ratio of "pieces of apparatus to consumers connected" or per premises provided the better indication of development. At Wimbledon there was a saturation of 46.4 per cent., not including those heaters which were publicly owned.

Maintenance of Apparatus

All self-contained heaters were cleaned out once in two years and four improvers were kept constantly employed in this work. The cost was 1d. per month per heater, which would fall in future with increasing use. Very little scale formed within the container; most of it was deposited at the top of the outlet pipe and anti-drip device. He had accordingly devised a new form of outlet pipe, a sample of which was exhibited, which could easily be removed for cleaning without disturbing the "apparatus plate," thus reducing the time and cost of cleaning to half. The 500 immersion type heaters in use in Wimbledon were of the self-cleaning type and there had been no failures. In twelve cases only had complaints been made and those heaters had functioned perfectly after ice in the supply pipes had been thawed.

It was to be regretted that the Electricity Commissioners had not seen fit to lengthen the loan repayment period in respect of water heaters in the same way as they had done for cookers, since the life of heaters was considerably longer than that of cookers.

Spring-loaded taps and valves should be fitted to all water heaters in public places. They would immediately stop all complaints regarding insufficiency of hot water. Change-over switches were fitted to all cookers and the 10,000 water heaters in his area and had functioned with complete satisfaction. Since the average time that a cooker was in use did not exceed four hours per day there was no complaint regarding the water heater and that method of load limiting had saved his undertaking several thousand pounds a year. If he had had automatic control of room heaters during the recent cold spell several more thousand pounds might have been saved in that respect also.

Mr. O. W. Humphreys said that the paper removed all doubt about the magnitude of the water heater demand and its value was self-evident. The author was justified in stating that all consumers could afford to heat water electrically, but not all of them could afford to use the same amount of hot water. Manual control of the heater might suffice to overcome this difficulty in some cases, but the objective should be education of the consumer to regulate his use of hot water. It was to be hoped that the B.S.I. specification would stimulate confidence in water heaters and increase the demand for them. That specification had been based on the E.D.A. recommendations which had stood the test of long trial in use. The employment of "Monel" metal in place of tinning for containers needed very careful consideration from the cost point of view. Electric water heating was not really a question of economy, since convenience could be valued at a large figure in many cases.

Estimating Consumer's Requirements

Mr. W. Millner said that the electric water heater could hold its own with any other type and had many advantages of its own, but the upper and lower limits of usefulness in commercial applications were not so simple to determine. In the case of wage earners it was practicable to determine the lower limit, but not for general unlimited use. Many such people obtained all the hot water they required from an ordinary wash boiler, which had a large field of utility. In office blocks the amount of water needed could be estimated, but in hospitals and hostels it was extremely difficult to obtain any useful estimate of the amount of hot water required. The undertaking with which he was connected had to install water meters in order to obtain figures to work with and figures so obtained were amazing, varying from 30 to 50 gallons per hour throughout 24 hours. In the particular case of a milk bar where there was no room whatever for storage the capacity requirement was for 100 gallons and 12 kW of heating had been installed, of which 6 kW was at the top for quick recovery. Constant use prevented the allowance of any recuperative period, and to provide equivalent service the amount of storage capacity that would have been required could not have been accommodated on the premises. His undertaking often had to deal with similar cases and he had found that the load factor was very satisfactory.

The Furring Problem

Mr. C. Hubert Smith considered that with efficient utilisation present types of heater would perform well at existing tariffs. It was not safe to assume that a galvanised steel tank could be used for all hard waters as some waters changed quite frequently and might become definitely corrosive. The success of electric water heating presupposed the provision of some storage capacity and the instant geyser idea had gone out of favour.

The author's remarks on water containers might stir up a hornets' nest. Since water might change in constituency, it could not be said definitely that the tinning of containers was unnecessary. In his opinion displacement and cistern types should be tinned, or some alternative metal such as "Monel" might be employed to avoid the need for tinning. Heating elements had attained a wonderful degree of reliability and their life was long. He could not altogether agree that scale deposit or furring was a function of local heating area. The only way to stop it entirely was by heating indirectly (by water) but that method was not practical in small types because of the lack of space in small containers. The present standard of loading was very satisfactory for all-round purposes, but it might often have to be increased for the requirements of particular communities.

More hard work had been spent in designing the 1.5 gallon class than in any other type. That size was satisfactory, but should be kept as simple as possible. One could not get the full use of the storage factor by means of a top entry circulator; an automatic immersion heater was preferable. Conversions of existing fuel systems should go hand in hand with a separate heater to work at a higher temperature at the sink, so minimising pipe losses. If a switch must be provided as well as a thermostat the latter should be allowed to control the whole load, while the switch should be used for half load only. The use of copper pipes fitted in well with electric heaters, but care must be taken not to mix copper pipes with iron tanks. One of the greatest difficulties was to find sufficient space in the ordinary house for a storage tank large enough (200 gallons) to do the job properly.

Scope for Instantaneous Heaters

Mr. R. W. Minter was critical. He considered the title of the paper was misleading and that the author had unjustly dismissed the instant heater type in a single paragraph. There were many cases in which this type would be preferable to thermal storage. He did not wish to run down the storage principle, but considered that it should only be applied where it was really appropriate. Some re-wording of the paper would make it of more value electrically and of less use to the gas companies. He considered that a switch-thermostat combination was preferable to a switch alone. The proper places for heaters were at the point of use, *viz.*, instant type at the sink and storage type in the bathroom, minimising pipe losses. The water heating load did not warrant the offer of special rates and was not the best type of load. Water heating was not even so good a load as cooking from the point of view of energy used. Room heating was a much more valuable load than either because of its long-hour use.

Mr. R. Grierson also considered the title of the paper to be somewhat misleading and said it was the first time that he had heard CO_2 named as the culprit in soft water districts.

More usually acids were the undesirable elements. The ratio of water storage capacity to the amounts of water used was the cause of diversity of results in similar cases; even the filling of a clothes washer would cause a sudden jump in heater load. By fitting condensers to "microgap-stats" they could be made suitable for use on either AC or DC circuits. He would prefer to use other forms of lagging than granulated cork packing and had found that for £7 10s. either a 1.5 gallon heater could be fitted or the existing fuel-fired system converted, so providing the user with a choice at equal cost. It would be futile to expect users to change their habits in order to accommodate themselves to the ways of electric heater operation.

He supported the view that circulators must be used with great discretion, since builders tended to reduce the size of cisterns and the short-length thermostat would prevent this type from giving the service expected of it. Airing cupboards need not be kept at an excessive temperature in order to dry clothes. Conversion jobs were the most difficult, since some most extraordinary piping systems were in existence. It was incorrect to assume that hot water could not be circulated downwards, while not all of the water authorities' regulations and requirements had been mentioned by the author. In hot cupboards and similar situations it was preferable not to use v.i.r. cable. He had an open mind whether high or low loading provided the better diversity factor.

Lagging Tests

Mr. G. O. McLean referred to lagging tests which his undertaking had carried out last summer. It was found that red cedar wood fibre was not quite so good a thermal insulator as cork granules, but it had a number of advantages which might compensate in other directions. It would remain in position, even when the outer casing was removed; it created no dust or odours and did not tend to "pack" when first applied, so avoiding the need for topping up which seemed to be necessary after a time when cork was used. It did not seem logical to argue so much about preventing a loss of 70 W per hour from the top of an average tank and at the same time counsel the installation of a heated towel rail from which the loss was at least 100 W per hour. Supply authorities were also blamed for the inability to make good tea with water from storage type heaters which maintained a temperature of 180 deg. F. or over. Tea-making required freshly boiled water.

The author, in reply, associated himself with the regret that had been expressed that the Electricity Commissioners had not seen fit to extend the loan repayment period in respect of water heaters. Automatic control was desirable whenever it could be arranged, but the fact remained that the use of hot water was extremely variable and a constant supply was not always needed or justified. There was a definite need for a thermostat calibration curve.

Valve Type Measuring Instruments

THOSE characteristics of thermionic valves that are of importance in the design of measuring instruments of which they form an essential part are discussed in a paper by Messrs. E. G. James, G. R. Polgreen and G. W. Warren (G.E.C. and M.O. Valve Co. research staff), which was read before the Meter and Instrument Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on January 6th.

The paper outlines the principles involved in AC valve-type voltmeters of various sorts, including the measurement of very small values of current and power, and such other applications as to harmonic analysis and the determination of frequency and physical quantities.

Amplifiers and oscillators used in conjunction with measuring instruments are not considered. The authors show how the various relationships of anode current to grid voltage depend on the geometry of the electrodes, their spacing, &c. They explain how input impedance is affected by electron and ion convection currents in the grid circuit; by capacitance between the grid and other electrodes and (at very high frequencies) inductance of the leads thereto, together with the finite transit time of electrons between the electrodes.

In the "acorn" type of valve, the smallness of the structure reduces to the minimum the transit time, inter-electrode capacitances, and lead inductances, so that this form of valve is very suitable for use in high-frequency voltmeters.

Stability of Characteristics

Although the uniformity existing between the characteristics of valves of the same type may not be as good as the instrument maker might wish, the modern valve gives a very stable performance during its life, particularly under the operating conditions imposed in measuring devices. The valve manufacturer usually subjects valves required for this purpose to a long ageing treatment, often as much as 100 hours, in order to stabilise the cathode emission and the contact potential differences between electrodes, since any drift in characteristics due to these factors is likely to be greater during the first few hours of operation than subsequently.

The stable operation of a device employing a thermionic valve depends not only on the stability of the valve characteristics, but also on the constancy of the applied voltages. Changes due to this cause can to a large extent be reduced by applying negative feedback to the amplified valves. This can be done in several ways; in instruments, usually by inserting a resistance in the cathode lead to the valve.

The popularity of valve type measuring devices is due to their sensitivity and negligible power absorption from the source. All AC voltmeters of this sort are essentially rectifiers, so that the authors classify them according to method of rectification when describing the "slide-back," peak, grid-leak and anode-bend varieties.

Only in rather exceptional circumstances, when the combination of very large input resistance and great sensitivity is needed, are DC valve voltmeters employed. Very complete electrical screening is necessary to prevent stray AC being picked up and to avoid charges accumulating on the bulb. In some cases it is recommended that the valve should be operated in the dark to prevent the emission of photo-electrons from the grid.

Current and Power Measurement

In normal instrument practice, current is measured by its magnetic or heating effect, voltage being determined by measuring the current through a known resistance. The converse procedure is adopted with valve type electrometers, voltage being measured by its controlling action on the electron current in a valve, while current may be determined by measuring the voltage produced across a known resistance. This method is particularly suitable for the measurement of extremely small DC, of the order of 10^{-16} A.

The measurement of small amounts of power at radio frequencies is not easy, but a fair degree of accuracy is obtainable from one mW upward with wattmeters of the thermionic triode type. Harmonic analysers employing push-pull valves and a comparative oscillator provide an accuracy better than one per cent. for a harmonic of 10 per cent. of the fundamental and about 3 per cent. for a one per cent. harmonic.

Frequency is most commonly measured by bridge methods or calibrated timing circuits, resonance being indicated by voltage or current. Neither method is direct reading and so will not measure rapid changes of frequency. A valve-type andio-frequency meter is not subject to these limitations and is suitable for recording frequency as a function of time, such as variations in speech and singing, the decay of artificial radio-activity and frequency monitoring or control.

Change in frequency of a valve oscillator when the timing capacitance is altered has been used for measuring physical quantities, for example, by change in length of a specimen altering the capacitance of a parallel-plate condenser. Also, change in the timing capacitance alters the impedance of the circuit, causing anode-bend rectification, and so can be used for measuring high resistance with an accuracy of about 5 per cent.

These applications indicate the growing importance to instrument designers of the thermionic valve in its special forms, some of which are described in this paper. The authors state that the chief field of application of the valve-operated instrument is multi-range test equipment of medium size, associated in many cases with amplifiers and local oscillators to ensure adequate range and flexibility of testing. In the past it has been exclusive to medium- and high-frequency work, but when low cost and small size are essential latest developments indicate that thermal and metal rectifier instruments will satisfy many of the practical requirements for frequencies up to and including ranges commonly used for radio and carrier telephony transmission.

Electro-magnetic Slip Couplings

IN a lecture before the JUNIOR INSTITUTION OF ENGINEERS in London on December 30th, Mr. G. L. Metz discussed the use of electro-magnetic slip couplings with geared Diesel engines for ship propulsion. It was explained that the purpose of such couplings was to enable several small high-speed Diesel engines to be used for driving a single or double propeller-shaft without any mechanical connection between them.

This type of clutch consists essentially of two electro-magnets of circular shape, the primary having outwardly directed radial poles wound with wire through which DC is passed from the ship's auxiliary electricity supply by means of brushes and slip-rings on the shaft to which the magnet casting is rigidly fastened, the other end of the shaft having the pinion of the reduction gearing attached.

The secondary magnet is cylindrical in shape and its internal periphery is furnished with slots in which stout copper bars are placed and short-circuited. This magnet is attached rigidly to the engine shaft. Both magnets are overhung and the

assembly brings them concentrically together, one inside the other, with an air gap between the opposing faces of about half an inch. Torque results from the interaction which tends to eliminate the difference between the speeds of the two parts of the coupling and thus effects the transmission of torque across the air gap of the coupling, at the same time smoothing out any cyclic irregularities set up by the engine.

The torque transmitted by the coupling is proportional to the product of the magnetic flux and the current in the secondary system of conductors. This torque causes the speed of the secondary part of the coupling to increase until it reaches a value below that of the primary part that is just sufficient to circulate the secondary current required to transmit the torque, the small difference in speed between the two parts of the coupling being termed the "slip." The efficiency claimed for the coupling is 98 to 99 per cent., and Diesel-engined vessels up to 4,400 HP running at 300 RPM are in service.

Comparison of Energy Sources

THE assessment of technico-economic factors in energy supply problems is attempted in a paper by Messrs. J. G. Bennett and R. L. Brown (British Coal Utilisation Research Association) that was read before the North-Western Section of the INSTITUTE OF FUEL at Manchester on January 10th.

The authors commence with the remark that very few comparisons of different sources of energy are convincing because the relative significances to be attributed to the very many factors involved do not readily admit of quantitative expression. Their line of attack is the postulation of a "consuming unit," which could be a single works manufacturing a definite product, a class of consumers in a given area, or a whole industry. The amount of a given form of energy taken by such a consuming unit during a given period of time will be determined by two factors of merit (economic and technical) and two perturbing influences (psychological deviation and development lag) which are examined mathematically in such a way as to permit a comprehensive scheme of statistical analysis of energy economics to be constructed.

Examples of applications of these conceptions include a ternary diagram (coal, gas and electricity) with rectangular co-ordinates representing technical and economic merits so that points within the triangle represent given combinations of these factors, together with a three-dimensional model indicating changes that occur over a long period of time. These indicate that since coal and gas cannot be used for all purposes, for instance, coal cannot supply a lighting system and there may be threshold values which coal and gas cannot exceed.

The authors express the hope that the various energy supply industries may at an early date join forces in a systematic investigation of the possibility of quantitative assessment of the factors involved.

Electrical Tests in Mines

ELECTRICAL testing for the maintenance of safety in accordance with the requirements of the Coal Mines Act, 1911, was the subject of a paper by Mr. F. C. Knowles that was read at a meeting of the South Wales Branch of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS at Cardiff on January 7th.

The author said it must be realised that in many cases complete tests could only be carried out when the circuits to be tested were "dead." This involved the colliery electrician in working at week-ends, and Mr. Knowles hoped that methods would ultimately be evolved that would enable the tests called for to be carried out during normal working hours.

Ammeters and voltmeters of the permanent-magnet moving-coil type needed, for the arduous conditions met with, to be designed and constructed so that the pivots of the moving systems were jewels which were spring seated to take the heavy jars which they were likely to receive. During recent years the copper oxide rectifier had enabled manufacturers to produce instruments of the permanent-magnet moving-coil type for use on AC. Such a system of construction had a number of advantages, among them being the very small current which was taken to operate such an instrument as compared with the moving-iron or dynamometer types. There were, of course, certain limitations to the use of rectifiers, and this was very pronounced with ammeters.

Dealing with earth-conductor testing instruments, Mr. Knowles said that under the regulations a periodical test was necessary for all cables, including the armouring or earth conductor. Instruments for this purpose were usually constructed in the form of a robust ammeter mounted in a case with a single alkaline cell capable of giving several amperes. The indicator was calibrated in ohms and provided with an adjustment, together with a test plate on the instrument for setting prior to the carrying out of the test. This type of instrument was developed at the suggestion of Mr. Horsley to provide a low-voltage equipment delivering a reasonably high current. In addition, there were special ohmmeters covering a wide range of low-resistance testing, operating from a portable battery.

During the last few years cases had arisen in which it had been difficult to obtain a satisfactory test due to the earth conductor having impressed upon it an extraneous EMF, in some cases DC and in others AC. To overcome these conditions and still obtain the true value of the resistance of the earth conductor, a modification of the low-resistance ohmmeter combined with the AC features of the earth tester previously described, had produced a satisfactory instrument for reasonably low resistance.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, January 19th. Institution, London, W.C.2. 6 p.m. "The Design of Fractional Horsepower Induction Motors," by Mr. N. F. T. Saunders.

Transmission Section.—Wednesday, January 18th. Institution, London, W.C.2. 6 p.m. "Long-Period Ageing Tests on Solid-Type Cables," by Messrs. T. R. Scott and R. C. Mildner.

Western Centre.—Monday, January 16th. Royal Hotel, Bristol. 6.30 for 7 p.m. Annual dinner.

North Midland Centre.—Tuesday, January 17th. Hotel Metropole, King Street, Leeds. 7 p.m. "The Marconi-E.M.I. Television System," by Messrs. A. D. Blumlein, C. O. Browne, N. E. Davis and E. Green.

North-Western Centre.—Tuesday, January 17th. Midland Hotel, Manchester. Annual dinner.

East Midland Sub-Centre.—Tuesday, January 17th. The College, Loughborough. 6.45 p.m. "Statistics for the Control of a Large Engineering Organisation," by Mr. H. Faulkner.

Northern Ireland Sub-Centre.—Tuesday, January 17th. 9, Wellington Place, Belfast. 6.30 p.m. "The Application of Electric Heating to Domestic Hot-Water Supply Systems," by Mr. J. I. Bernard.

Devon and Cornwall Sub-Centre.—Wednesday, January 18th. The Athenæum, George Street, Plymouth. "Line Protection by Petersen Coils," by Messrs. H. Willott Taylor and P. F. Stritzl.

Sheffield Sub-Centre.—Wednesday, January 18th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "Choice of Motor for Industrial Drive," by Mr. R. A. H. Sutcliffe.

Irish Centre.—Thursday. January 19th. Trinity College, Dublin. 6 p.m. "Empire Telegraph Communications," by Mr. K. L. Wood.

Junior Institution of Engineers.—Informal meeting. Friday, January 20th. 39, Victoria Street, London, S.W.1. 7.30 p.m. "Television," by Mr. H. J. Shaw.

Association of Mining Electrical Engineers *(Yorkshire North-West Branch).*—Saturday, January 14th. Wakefield. "Colliery Cables," by Mr. F. D. Milner.

West of Scotland Branch.—Saturday, January 14th. Joint meeting with the Colliery Managers' Association (Scottish Branch). "The Standardisation of Mining Electrical Equipment," by Mr. W. Reid.

Electrical Power Engineers' Association *(South Coast Section).*—Tuesday, January 17th. Technical College, Brighton. 7.30 p.m. "Turbine Lubrication," by Mr. Campbell Robb.

Midland Technical Group.—Monday, January 16th. Grand Hotel, Birmingham. 7.15 p.m. "Industrial Sales Development," by Mr. W. E. Swale.

Institution of Civil Engineers.—Tuesday, January 17th. Institution, Great George Street, S.W.1. 6 p.m. Joint meeting with the Société des Ingénieurs Civils de France (British Section) and the Institution of Structural Engineers. "The Strengthening of the Austerlitz Bridge (Paris) by Electric Arc Welding," by Monsieur Fauconnier.

Illuminating Engineering Society.—Tuesday, January 17th. 32, Victoria Street, S.W.1. 7 p.m. Discussion on "Lighting in Relation to A.R.P."

Paisley Association of Electrical Engineers.—Tuesday, January 17th. 39, High Street, Paisley. 7.15 p.m. "Meters and Metering Equipment," by Mr. J. Mendelson.

Association of Supervising Electrical Engineers.—Tuesday, January 17th. 2, Savoy Hill, London, W.C.2. 7.15 p.m. "Electro-Medical Apparatus," by Mr. J. L. S. Baxter.

Leeds Branch.—Tuesday, January 17th. Electricity Showrooms, The Headrow, Leeds. 7.30 p.m. "Industrial Electrical Heating and Air Displacement," by Mr. F. L. Fletcher.

University College.—Tuesday, January 17th. Gower Street, London, W.1. 5.30 p.m. "History of the Thermionic Valve at University College," by Sir Ambrose Fleming.

Royal Society of Arts.—Wednesday, January 18th. John Street, Adelphi, W.C.2. 8.15 p.m. "Recent Progress in Television," by Mr. H. L. Kirke.

Proposed Prague Underground Railway

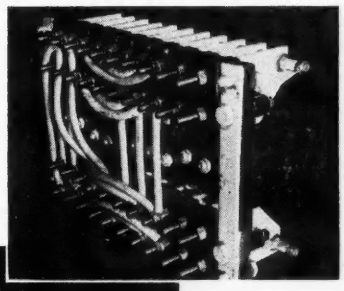
According to *La Journée Industrielle* plans for the construction of an underground railway in Prague were recently placed before the Municipal Council. It is proposed that work shall be commenced immediately upon two lines involving 6 km. of tunnels to be run under roads to avoid interference with the foundations of buildings. The cost of constructional work is put at kr.250 millions while rolling stock costing kr.70 millions would be provided.

NEW ELECTRICAL PRODUCTS

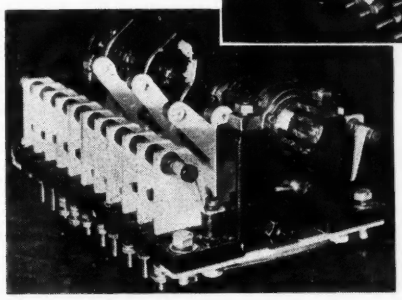
A review of equipment recently marketed

Controller for Machine Tools

A CAM-OPERATED controller for machine-tools and other machines designed for multi-speed reversing and driven by multiple motors is announced by BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester. It is of "unit" construction and is thus easily modified for a variety of switching combinations. It can also be conveniently built into a cavity in a machine casting and yet be accessible and simple to withdraw. One or more operating handles engage through a simple clutch with one or two shafts, independent or concentric, which actuate (say, twelve) cam-roller mechanisms. The latter move rocker cams, each carrying triple-pole double-break contacts at each end, so that switching and speed selection can be made with one handle while forward and reverse rotation is controlled by the other; the handles can be of different types. Each shaft is fitted with a compression-spring-controlled check cam of a double roller type, or a simple steel ball notching device for less frequent operation.



The Brookhirst cam-operated controller

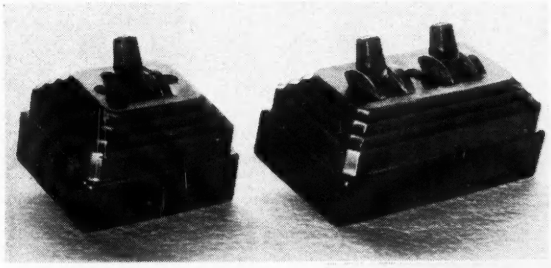


The moving contacts are short half-round copper rods, each held in a "box" by a spring and centring pin. The fixed contacts are the hexagonal heads of copper screws within brass terminal posts, the studs of which extend through a bakelite base to form the terminals. Both fixed and moving contacts are thus easily renewable, the arc shields can be removed en bloc and the shafts can be provided with "Oilite" bearing bushes.

Domestic Switches

Unusual appearance characterises the "New Moorsom" switches of SPERRYN & Co., Moorsom Street Works, Birmingham, 6. They are rated at 5 A, 250 V and are fitted with a q.m. and b. underslung movement and a shockproof cover in brown, white or walnut. The moulded dolly is metal reinforced and the base is of vitreous porcelain. Projection is $1\frac{9}{16}$ in. and single switches measure $1\frac{3}{4}$ by $1\frac{5}{8}$ in.

A twin unit has been specially designed for competitive wiring schemes and is intended for positions where two switches are required on a single block. Its small size (3 in. by $1\frac{5}{8}$ in.)



The "New Moorsom" switches

enables it to be mounted anywhere in a horizontal position, obviating the necessity of stocking specially drilled blocks for vertical mounting. Two screws only are required to fix the unit to the block and one screw to fix the cover which is self-positioning. A single feed-wire serves both sides of the unit, thus eliminating the loop wire. The twin unit can be supplied with two one-way, two two-way or one one-way and one two-way switches.

The same single and twin units are obtainable also as flush assemblies, without a box or with wooden or iron boxes. A circular surface pattern is also available.

Drying and Purifying Transformer Oils

The Lister filter presses have been designed for the purpose of freeing transformer oil from dirt and sludge and removing moisture. Oil is forced through filter paper at a pressure of from 50 to 100 lb. per sq. in., the filter removing the sediment and moisture. It is not, of course, intended for the removal of water in bulk but only the last traces of moisture.

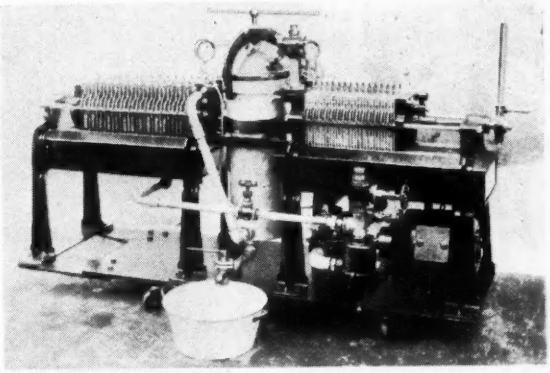
The operation of the filter press does not depend upon the oil being heated and the temperature of normal filtration is such that the water content of the oil never exceeds the absorptive power of the filter paper. The oil is not exposed to the air when passing through the machine, which employs specially hard calendered paper. Several sizes and types up to 35 gal. per minute are supplied complete with an electric drying oven, as it is necessary to dry the paper carefully.

The circulation of the oil through the filters is effected by means of an electrically driven pump designed to prevent turbulence in the oil and thus preventing bubbles. The makers are GEORGE LISTER, GLOUCESTER (1937), LTD., Broadway, Dursley, Glos.

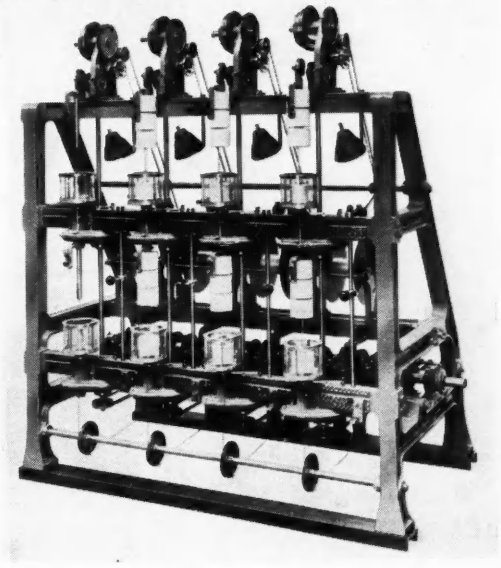
Wire Covering Machine

The model "C" wire covering machine of J. B. HYDE & Co., LTD., Wythenshawe, Manchester, is a new introduction by this company for double covering four lines of wire of from No. 16 (0.064 in.) to No. 30 (0.0124 in.) SWG. Machines are supplied with the number of heads in multiples of four per section. The nosepieces are obtainable with bores of 0.085 to 0.025 in

The machine is built up from a steel channel base with exceptionally heavy side frames and cross rails, to minimise vibration and so improve precision of covering. The 2-HP motor is built within the frame and, instead of gearing, the transmission from the horizontal main shaft on ball bearings to the vertical worm shafts is by endless "V" belts. Each head has an individual clutch running on double ball bearings on the main shaft instead of the usual position on the worm shaft, which makes it possible to have unusually large clutches with exceptionally long "travel." A brake with "Ferodo" lining, spring loaded and adjustable, is incorporated in the clutch mechanism.



The Lister oil purifier and filter plant



The Hyde wire covering machine

From the vertical worm shafts the drive is transmitted to the flyer spindles through enclosed precision gearing. The flyers are of special alloy, lighter and stronger than aluminium, and are of the four post type with a specially designed final guide post by means of which any desired angle of lay can be obtained. From cop to wire the yarn retains its original flat tape form with no twists or turns. Totally enclosing, but revolving with the flyer, is a

D

cover of transparent material. Although completely covering not only the cop but also the yarn right up to the covering point, the cover enables the operator constantly to observe both cop and yarn-travel when the head is running at any speed.

These covers are easily removable for threading up or correcting tangled cop. Yarn tension is applied to a centrally located spring above the copholder by an outside fulcrum lever by means of which adjustment is made while the head is running by simply turning a knurled headed screw without the use of any kind of tool.

The nosepieces have a long throat to permit the use of a large range of angles of lay and are fitted with polishers having adjustable spring loading. Five steps of different diameter are provided on the capstan, which can be centralised to suit each step, and single-change gears are employed, the intermediate gear, mounted on a quadrant, having a quick-release device actuated by a handwheel.

Individual automatic traverse mechanism is provided for each head, which is a self-contained unit in that the worm shaft, gear box and capstan bracket assemblies are mounted on the cross rails as an alternative to passing shafts through them.

The spacing of the heads allows for interchangeable flyers, nosepieces or other special attachments for taping and tinsel covering. Lubrication is by the "Tecalemit" system with a simple grease gun.

Luminous Paints

A new hard but elastic luminous paint which is resistant to water and atmospheric conditions is being handled in Great Britain by F. ARNOLD BEST & Co., 21, Old Queen Street, London, S.W.1. It can be applied by brush or spraying gun.

The paint is made in two types, the inactive and the radio-active. The former will function only after exposure to natural or artificial light, and the duration of its power to illuminate depends upon the quality of the luminous paste and the length of time for which it is first exposed. It can be used where a dull natural light is available for such purposes as indicating the position of electric light switches and the position of exits in the event of failure of artificial light.

The more expensive radio-active paint consists of the inactive luminous type with the addition of phosphorus. It remains continually luminous without exposure to light, and its uses include the illumination of instruments and switch-buttons for electric lamps and of advertising signs (in fog) in conjunction with ultra-violet rays.

Either type can be applied to the manufacture of articles made from plastic material making it luminous in the dark throughout its mass.

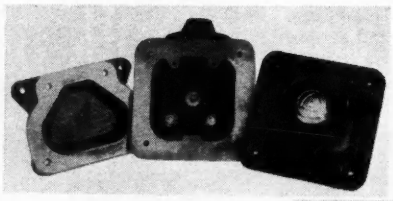
The process can also be adapted to the metallising of non-metallic materials. When used for the internal screening of radio apparatus, it is claimed to provide complete protection against external influences. For this purpose only a blower, spraying gun and drying oven operated at about 150 deg. C. are required.

Emergency Switches

Two new emergency switches, embodying all the good qualities of previous designs together with several improvements, have just been added to the range of Ellison emergency switches made by GEORGE ELLISON, LTD., Perry Barr, Birmingham, 20.

The switches are strongly and simply constructed, with the push knob operating direct on to the switch. Their strength and mechanical simplicity make it impossible for them to be damaged by excessive force, used in a moment of emergency.

Self-resetting action is incorporated and the switches can be arranged either to open or to close a trip-coil circuit in a circuit-breaker or motor starter. The switches can be wired easily; in the case of the flameproof type it is only necessary to remove the square front plate. They can be installed with the cable gland at the top, bottom or sides, and the front plate bolted in its correct position, with the shroud above the knob. In the case of the sealed switch the hinged front cover simply swings open.



Flameproof (left) and sealed Ellison emergency switches

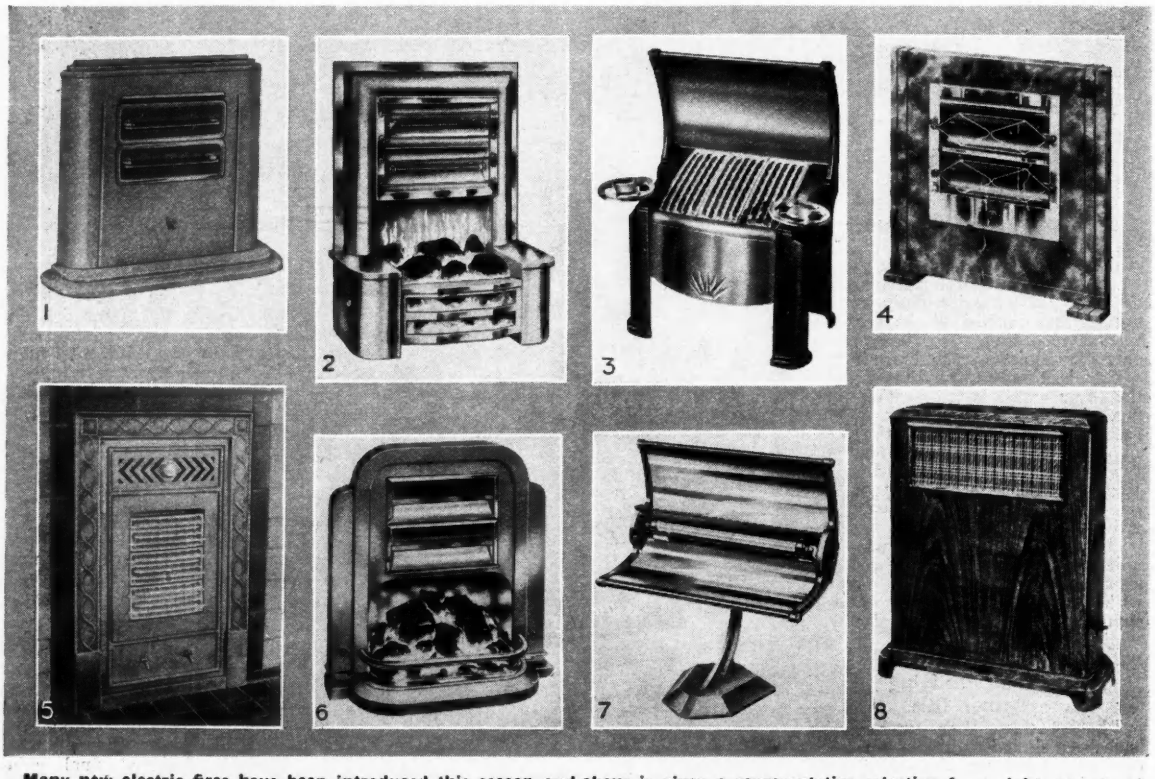
The flameproof switch is for use in mines, gasworks and where explosive atmospheres occur. It has been passed by the Mines Department testing station at Buxton for use in methane, acetone and petroleum vapours.

The switch makes a suitable ringing key, and the contacts can be arranged, if required, for morse signalling.

The sealed switch is designed to prevent accidental or unauthorised operation. The glass is broken and the switch operated by the attached hammer; replacements for the square glass can readily be cut.

Soldering and Brazing

RUNBAKEN ELECTRICAL PRODUCTS, 13/15, Liverpool Road, Manchester, 3, are marketing shortly a new electric soldering and brazing machine with infinitely variable control, a sliding control giving heats suitable for soft solder or up to cherry red for light brazing.



Many new electric fires have been introduced this season and above is given a representative selection from eight manufacturers. In most cases the example shown is but one of several models or one of a range

1. Simplex Electric Co., Ltd. ("Chiltern"). 2. Revo Electric Co., Ltd. ("Thames"). 3. H. G. Moseley & Co., Ltd. 4. English Electric Co., Ltd. (adjustable screen fire). 5. Hedin, Ltd. 6. Berry's Electric, Ltd. ("Joyberry"). 7. Siemens Electric Lamps & Supplies, Ltd ("Surrey"). 8. Belling convector heater.

Biscuit Manufacture

How electricity is utilised at a new extension to a Bermondsey factory

PRESENT-DAY foodstuff production methods demand that every precaution shall be taken to ensure maximum cleanliness and hygiene. That is why electricity is used so extensively in the new extension to Peek, Frean & Co.'s biscuit factory at Bermondsey, not only for all the machinery drives but also for cooling, automatic control and counting.

Chocolate work is carried out on the ground floor of the new building. The chocolate is melted down in five kettles stirred through belt drive by means of a 10-HP electric motor, which also drives the four slowly moving conveyors on which the biscuits to be coated are placed. On these they are carried through the enrobing machines, the largest of which is driven by a 3-HP motor and is equipped with an electric pump and also has one 1,000-W and three 500-W electric heaters to prevent the chocolate setting in various parts of the machine. Electric fans of 2-HP output blow off the surplus chocolate so that the finished biscuits are of the correct weight.

The subsequent cooling process is most important. Leaving the enrobeurs, the biscuits are, in the case of the largest machines, cooled in a long tunnel by means of conditioned air supplied through an insulated duct from a J. & E. Hall ammonia compressor plant working on the direct expansion system. Operating the compressor is a 7-HP variable-speed motor which, like most of the other new plant, is provided with a vee-belt drive. The other production lines from the smaller enrobeurs are also supplied with conditioned air through separate ducts from the same plant.

Conveyors assist considerably in the assortment packing of the 4-lb. and 9-lb. tins on the first floor. Two ring units ("Sovex") in four sections completely encircle the department and are arranged one above the other, the lower one supplying the empty tins and the top one carrying them away, *via* a further cross conveyor, for labelling, weighing and despatch in the old building. Each of the four sections of the ring conveyors is driven by a 3-HP motor controlled by Bray starters and Simplex switchgear.

The supply of empty tins to the lower conveyor is regulated by means of a Radiovisor photo-electric cell relay equipment operating from a 240-V circuit. Should no tins pass the light beam from the 100-W "Osram" projector lamp focused across their path for a period of seven seconds, the feeding conveyor automatically starts up and supplies empty tins to make up the deficiency. In the meantime the tins already on the conveyor are held up, in order to avoid collisions, by means of a friction brake which, when a certain number have accumulated, is released and the tins, passing across the light ray, stop the feeding conveyor and so travel round the room.

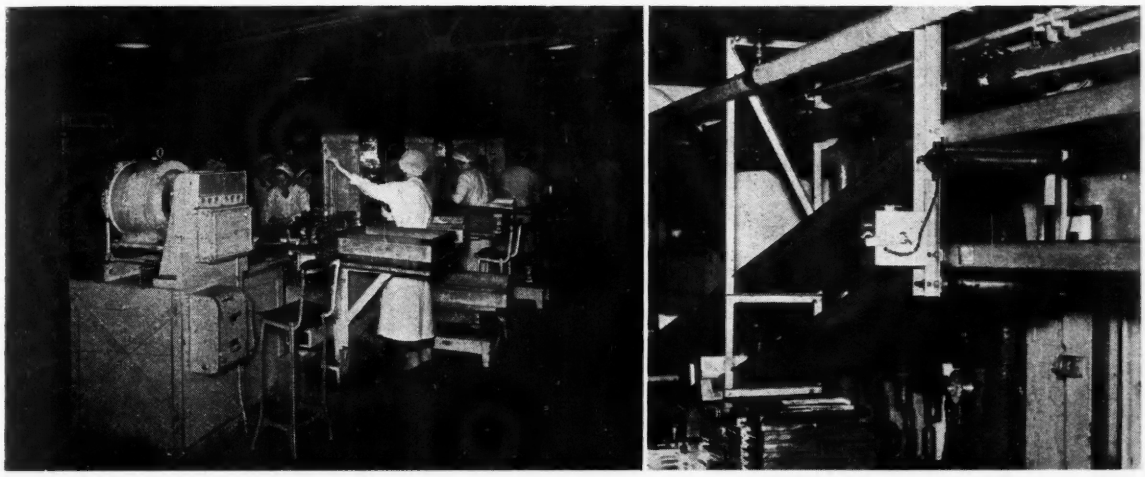
Actual packing of the various assortments in the tins is done on six rotary packing tables each driven by a 1¼-HP variable-speed motor through a worm reduction gear and chain and sprocket drive. The tins travel gradually round, each operator putting in one particular kind of biscuit or packing. Incidentally, when packing, to preserve a regular standard of product, a close watch is kept on the colour of the biscuits, there being certain definite limits of darkness or paleness. For this purpose a number of special colour-corrected lamps are employed.

In the carton and packet room on the second floor 1¼-HP variable-speed motors enable the ten conveyors to be run at speeds suitable for dealing with each particular assortment. After the various components (paper, packing and biscuits) have been placed on the conveyor they pass over a weighing machine and packing and labelling is completed. Some of the wrapping in airtight cartons is done on an "S.I.S." machine which wraps at the rate of 55 packets a minute, while on one of the packet production lines is a G.E.C. photo-electric counting device which automatically records output on a large indicator. On this floor also is situated a B.T.H. public address system from which music is reproduced in several rooms of the new building between 11 a.m. and noon and from 4 to 5 p.m.

Cartons for export are metal ended and wax sealed. A clamping machine puts on the metal ends while the wax sealing is carried out semi-automatically by means of a machine operated by a ¼-HP motor with a limit switch working on cams to give the correct period of immersion. The heating of the tanks of liquid paraffin wax is effected by three 2-kW Simplex immersion heaters controlled by three-heat switches.

Eighteen machines of the company's own design and manufacture are used for putting cream in sandwich-type biscuits. They work in batteries of six, each served by a 5-HP, 1,100-RPM Verity motor, and the biscuits are carried away on conveyors by the same motors. A further conveyor is provided for hand creaming of biscuits too awkward in shape or required in too small quantities to be done by machine.

Most of the electric motors installed were made by Laurence Scott and Electromotors, Ltd., and have Brookhirst switchgear. The installation was carried out by Peek, Frean & Co.'s own electrical staff who employed Henley's cable and Simplex conduit and switches throughout.



[*Elec. Rev. photos.*

Left: A 5-HP motor driving a battery of six creaming machines and also a conveyor. Right: Radiovisor photo-electric cell relay equipment regulating the supply of empty tins to the ring conveyor in the assortment packing department

The N.P.L.

THE fees charged for having instruments tested and the performance of materials verified at the National Physical Laboratory are now in many cases appreciably lower than they used to be. The scope of tests regularly undertaken in the Heat, Acoustics and Radiology Divisions of the Physics Department is fully explained in three new pamphlets obtainable from the Laboratory at Teddington, Middlesex.

Vol. 24 of the N.P.L. "Collected Researches" has just been published by H.M. Stationery Office, at £1 2s. 6d. net. Apart from an illustrated account of an investigation of problems relating to the use of pivots and jewels in instruments and meters, this volume has been reserved for papers relating mainly to fundamental standards, a number of which have not previously been published. Vol. 25 appeared in 1936, and the series has now been discontinued. Its place will be taken by an annual collection of abstracts of the papers published by the Laboratory during the preceding year, together, it is hoped, with periodical monographs on various subjects of research upon which the Laboratory is engaged.

NEW BOOKS

Rectifiers, Circuit Design, Switchgear and Telecommunications

Rectification of Alternating Current. By H. RISSIK. (Pp. 217; figs. 97.) London: English University Press. Price 21s.

THIS book forms a useful addition to the literature of the subject. It surveys the various types of rectifier, dealing not only with the large mercury-arc type but also with the smaller kinds of rectifiers used in radio work. As these widely different types are often used together in practice, their association in the same book is welcome.

As befits a book intended for the student and also for the electrical engineer, the recent history of the development of non-vacuum rectifiers, including some of the more experimental types, has not been overlooked, though perhaps a reference to the "Ignitron" would have been appropriate. A pleasing feature is the example given at each stage of the basic equations associated with the working of the rectifier types. The book is written in an easy style, the presentation of the physical phenomena is essentially descriptive in places, and interest is sustained throughout.

The book falls admirably into three sections, starting with a generic definition of rectifiers, discussing their chief characteristics and dealing discreetly with the difficult question of measurements in rectifier circuits. The chapter on fundamental circuit relations, on orthodox lines, is one of the best in the book. Part II, which deals with the physical principles of rectifier phenomena, gives a useful comparative survey of the mechanisms underlying the various types of rectification and enhances the reference value of the book. The technique of AC rectification is discussed in Part III, wherein a clear insight into the operation of the transverter and other mechanical rectifying devices is given. This is followed by chapters dealing with the various thermionic rectifiers, both large and small, and arc rectifiers.

The chapter on arc rectifiers provides the first reference in book form to the large scale development of the air-cooled steel tank pumpless mercury-arc rectifier. More detailed information about the actual grids used in grid control might perhaps have been introduced. The book also points out the significance of rectifiers of the Marx type in relation to the problems of high-voltage DC transmission. A final chapter about the copper-oxide and similar rectifiers develops the ideas put forward in an earlier section.

Though the book necessarily includes some items already familiar to experts, the author's lucid presentation makes it a valuable source of information and inspiration to all concerned.—W. G. T.

Electric Circuits and Wave Filters. By A. T. STARR. (Pp. 476; figs. 402.) Second edition. London: Sir Isaac Pitman & Sons, Ltd. Price 21s. net.

This book, published four years ago, has proved of value to electrical engineers who are interested in problems pertaining to communication and power distribution. The advance in the subjects dealt with has been so exceptionally rapid that this second edition is sure of a warm welcome, especially as the author has made full use of his opportunity to bring the text up to date and substantially increase its bulk with descriptions of the latest developments, especially those connected with wave filters.

The first third of the book is devoted to the theory of alternating currents and electric circuits generally, including the design of resistances, coils, condensers and impedances; the remainder, with networks and filters. The network portion consists of chapters on four-terminal networks and transients in networks; the filter portion of chapters on wave filters, low pass filter, high pass filter and band pass filter. There are a number of appendices and a good index.

The applications of the theory of circuits and networks come into so many branches of electrical engineering that this volume, which covers so well the theoretical considerations of present-day practice, should certainly continue to be of great value, not only to the student, but to the trained engineer. This is a book which can be confidently recommended.—C. G. C.

The Switchgear Handbook. Edited by W. H. COATES and S. PEARCE. Vol. 1. (Pp. 190; figs. 106.) London: Sir Isaac Pitman & Sons, Ltd. Price 16s.

The extent of progress in switchgear practice and design the past decade has rendered many existing works on the subject largely out of date. During that period, too, there has been a dearth of books, thus increasing the need for a modern work. The first volume of this new work fills the gap to some extent and is a definite contribution towards intelligent switchgear application. The complexity of switchgear problems makes it extremely difficult for any one individual to attempt a comprehensive work and so, in this case, there are no fewer than sixteen contributors (all on the engineering staff of the Metropolitan-Vickers Electrical Co.) each an expert in one or more branches of the art. Such a galaxy of talent should undoubtedly add to the value of the work.

The present volume deals with apparatus, covering theory of design, insulation, circuit-breakers, fuses, instrument transformers, over-voltage protection and voltage regulation. The preface indicates that the object has been to write more for the interested user than the designer. Nevertheless, certain material seems to be purely for the designer, as, for example, much of that under the sub-heading of "Heating of conductors," particularly with such items as metalclad conductor casings. Similarly the very interesting and valuable discussion on arc phenomena appears heavy going for the interested user.

A valuable section is devoted to modern circuit-breakers, including notes on short-circuit testing, arc-control devices and theory, and impulse and other forms of circuit-breakers. The importance of dealing in current values at stated recovery voltages, as opposed to MVA ratings, is referred to. "Except among experts," the book says, "the use of MVA figures is apt to introduce misunderstanding and error." Even greater stress might be laid on a matter which really is of value to the interested user. An example or two illustrating "misunderstanding and error" would have been valuable.

The illustrations throughout are good and while many of them are of Metropolitan-Vickers products, they all represent good general practice. It will be easier, of course, to assess the full value of the work as other volumes become available, when it can be judged as a whole. It may be that later volumes will remove any cause for criticism from the users' point of view.—R. T. L.

The Radio and Telecommunications Engineer's Design Manual. By R. E. BLAKEY. (Pp. 142; figs. 84.) London: Sir Isaac Pitman & Sons, Ltd. Price 15s.

This book deals with the principles of the design of radio apparatus, and arrangements for testing and measuring. The author has had much experience in work of this sort and not infrequently makes use of it in balancing the pros and cons of different methods of attacking a problem, which naturally enhances the value of the book for designers and experimenters in the same field.

Many useful tables and data are included in addition to calculations and examples, and many types of testing apparatus, selected from well-known makes, are described. The matter is well set out, and written from a practical as opposed to an academic point of view. The text covers a wide field, comprising attenuators, inductances, condensers, transformers, audio- and high-frequency sources, valves and measuring apparatus, so that the subjects are necessarily dealt with very concisely; but there are frequent references to articles and books where more detailed information is available if desired.

This little manual should be found very useful when designing radio circuits, or testing and measuring the components used.—C. G. C.

Werner von Siemens Lebenserinnerungen. 13th edition. (Pp. 298.) Berlin: Julius Springer. Price 3.90 RM.

This autobiography of Werner von Siemens has been very popular in Germany. It gives a broad outline of the personal experiences of the author, from his childhood in agricultural circles in Brunswick, till the evening of his life, when he had retired from his position as chief of the huge Siemens companies.

The story of the author's struggles and achievements is one of exceptional interest. His work in electro-technology, particularly in the domain of telegraphy, has been of world importance, and its genesis and development are described in a vivid manner. There is also much valuable information regarding the pioneer sociological institutions introduced by the Siemens brothers, such as their workers' welfare and superannuation schemes, in which the author was the main driving force.

Many personal observations on famous scientific contemporaries are made, which reveal his opinions of them and of their countries in a way which is of considerable topical interest. There is some evidence of belief in the use of the "jack-boot" which must have amused the "spirits ironic," but on the whole the author emerges as a great, forceful and kindly man.—C. W. M.

Shorter Notices

The *Mechanical World* Year Book for 1939 (Pp. 718, Price 1s. 6d.) has just been issued by Emmott & Co., Ltd., Manchester. The time has now come when alloyed metals are in widespread use and more concise tabular information of their properties and preparatory treatment is required. In this edition a collection of up-to-date information of this kind is presented.

"Meter Engineering," by J. L. Ferns. 3rd ed. (Pp. 347; figs. 194.) Price 12s. 6d. "The Nomogram," by H. J. Allcock and J. R. Jones. 2nd ed. (Pp. 224; figs. 77). Price 10s. 6d. "The Performance and Design of DC Machines," by A. E. Clayton. 2nd ed. (Pp. 445; figs. 275.) Price 16s. London: Sir Isaac Pitman & Sons.

"Plan and Serve," by A. P. Young. (Pp. 140.) London: Management Publications Trust. Price 3s. 6d.

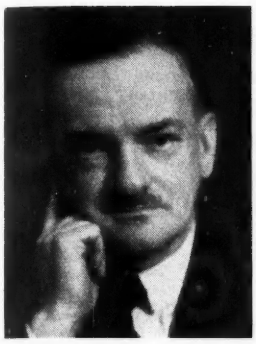
"Kunststoffe," by Dr. F. Pabst and Dr. R. Vieweg. (Pp. 91; illus.) Berlin: VDI-Verlag. Price RM3.

"Aluminium Bronze." (Pp. 151; illus.) London: Copper Development Association.

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

THE directors of the North-Eastern Electric Supply Co., Ltd., have appointed **Lt.-Col. S. E. Monkhouse,** M.I.E.E., managing director of the company, and **Mr. E. H. E. Woodward,** M.I.E.E., has been appointed general manager. These



Lt.-Col. S. E. Monkhouse

[Lafayette
Mr. E. H. E. Woodward

appointments date from January 1st. Lt.-Col. Monkhouse joined the company in 1904 and became general manager on April 1st, 1937. Mr. Woodward has been associated with the company since 1909 and has been deputy general manager since April, 1937.

Mr. R. W. L. Phillips, who recently retired from the position of borough electrical engineer at Bedford after about thirty-seven years' service, has been elected an honorary member of the Incorporated Municipal Electrical Association in recognition of his services to that organisation.

Mr. T. W. Jackson, charge engineer in the Electricity Department of the South Shields Corporation, has retired and has been succeeded by **Mr. A. McArdle,** relief engineer.

Mr. A. E. Morgan, B.Sc., A.M.I.E.E., technical assistant with the West Ham Corporation Electricity Department, has been appointed assistant borough electrical engineer at Barnes.

Leeds Corporation Transport Committee has appointed **Mr. J. S. Hamilton,** chief assistant electrical engineer, as electrical and tramways rolling stock engineer at a commencing salary of £750 per annum.

Mr. J. F. Franklin, joint managing director of Black & Decker, Ltd., sailed on the s.s. *Cape Town Castle* on January 5th for a protracted tour of the company's interests in South Africa. Mr. Franklin will visit Cape Town, Port Elizabeth, East London, Durban, Johannesburg, Bulawayo, &c., and in addition to his company's interests, he will visit, on behalf of Van Dorn Electric Tools, factors and distributors handling Van Dorn products in South Africa. He expects to be back in this country by the end of March.

Captain A. J. Beckett, M.I.E.E., resident and consulting engineer to the Bridlington Electricity Department, the recent progress of which is described on p. 43, has held his present position since 1904. Born on January 1st, 1874, at Houghton-le-Dale, Norfolk, he was educated at Bedford School, receiving his technical training at King's College, London; the Brush Electrical Engineering Co., Ltd., Loughborough; and Nottingham University. Between 1894 and 1904 he held successively the positions of central station and equipment contracts engineer, Brush Electrical Engineering Co., Ltd.; mains and street work superintendent, British Insulated Cables, Ltd.; assistant to Mr. Crummie, consulting engineer, Bedford; assistant engineer, Belfast Corporation Electricity Department; and chief assistant, York Corporation Electricity Department. During the War he served in the Royal Engineers and the Royal Navy. Ever since its inception in May, 1919, Captain Beckett has represented Group "C" on the National Joint Industrial Council for the Electricity Supply Industry, and is a member of the area committees of both the E.D.A. and the I.M.E.A. Having reached the age of sixty-five he was due for superannuation on January 1st, but the Town Council has extended his appointment for twelve months.

Captain A. J. Beckett

The Postmaster-General announces the appointment of **Mr. J. J. McKichan,** O.B.E., chief regional engineer, Scotland, as regional director, Midland Region, England. Mr. McKichan will not take up the new appointment until October 1st, and until that date he will be deputy regional director, Scotland. He entered the Post Office service in Glasgow in 1900. In 1910 he gained the City and Guilds (London) certificates in magnetism and electricity, and ten years later he was transferred to the engineer-in-chief's office in London, and was promoted executive engineer in 1929. Promotion to superintending engineer in the Scotland East district followed in 1934, and when the Scottish Region was formed in 1935 Mr. McKichan was appointed the first chief regional engineer.

Sir Frank E. Smith, who, as announced last week, has been awarded the G.B.E. in the New Year Honours, is to relinquish his appointment as secretary to the Committee of the Privy Council for Scientific and Industrial Research on January 31st to become adviser to the Anglo-Iranian Oil Co., Ltd., on scientific research and development. He is sixty-two. To succeed him the King has approved the appointment of **Professor E. V. Appleton,** D.Sc., LL.D., F.R.S., who is Jacksonian Professor of Natural Philosophy in the University of Cambridge and Fellow of St. John's College, Cambridge. He is also chairman of the National Committee for Radio Telegraphy and president of the International Union for Scientific Radio Telegraphy. He will take up his new appointment on February 1st.

Barratts Photo Press, Ltd.
Professor E. V. Appleton

Mr. R. Ll. Welsby has been appointed assistant in the mains department of the Welwyn Garden City Electricity Supply Co. For eight years he was with the Beckenham Electricity Department, first on the generating station staff and later as assistant in the mains department.

Professor Francis Hodgkinson, of Columbia University, has been awarded the Holley Medal by the American Society of Mechanical Engineers, reports the *Electrical World*, for meritorious services in the development of the steam turbine. Professor Hodgkinson retired from the position of consulting mechanical engineer to the Westinghouse Electric & Manufacturing Co., after 40 years of service, in 1936. He was born in London, and became associated with Sir Charles Parsons in the early development of the reaction steam turbine, later becoming superintendent of the erecting and fitting shops for C. A. Parsons & Co. In 1896, when George Westinghouse negotiated a license agreement with Sir Charles, Mr. Hodgkinson went to the Westinghouse Machine Company to initiate the design and construction of steam turbines. He became chief engineer in 1916, and in 1926 was appointed consulting mechanical engineer to the Westinghouse Electric & Manufacturing Co.

Mr. H. A. Greenfield, a prominent electrical contractor at Norwich, was nominated chairman of the Norwich and District E.D.A. Circle at its annual meeting on January 3rd.

Mr. S. F. Colman, A.C.G.I., A.M.I.E.E., has been appointed sales manager of the Power Equipment Co., Ltd., Kingsbury Works, Hendon, N.W.9. He received his technical training at the City and Guilds of London Institute and served his apprenticeship at the Stafford works of the English Electric Co., Ltd. Upon completing his apprenticeship he was engaged in the equipment of extensions to the Stafford works of the company, and then joined the sales departments at Stafford and Queen's House, Kingsway. In 1927 he went to Malaya to become manager of the company's Eastern branch at Ipoh, Perak, F.M.S. Returning to England in 1933, he was appointed export liaison engineer at the head office at Stafford.

[Elliott & Fry
Mr. S. F. Colman

In 1935, having completed a period of twelve years with the English Electric Co., he joined Johnson & Phillips, Ltd., as assistant manager of the company's Bristol branch.

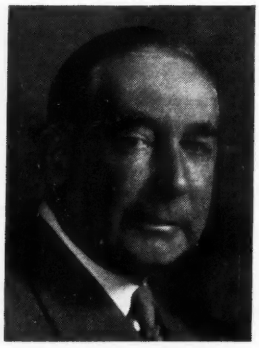
Several changes have taken place in the staff of the Liverpool Electric Power and Lighting Department in consequence

of the retirement of **Mr. W. H. Warburton,** inspector of mains. His successor is **Mr. E. S. Hay,** who until recently filled the position of canvassing assistant. **Mr. C. C. Smith,** who was temporary assistant inspector, has been appointed canvassing assistant.

Sir Alexander Roger, chairman of the Anglo-Portuguese Telephone Co., Ltd., is now visiting Portugal. He will return on or about January, 25th.

Seventy members of the staff of Davis Myer & Co., Ltd., and their friends attended the company's annual dinner at the Bedford Corner Hotel, Holborn, on December 23rd. Presentations were made to the directors from the staff.

Capt. B. S. Cohen, whose survey of the Physical Society's Exhibition appears elsewhere in this issue, retired on December 31st from the position of Director of Research at the Post Office Research Station, Dollis Hill. Capt. Cohen has been associated with telecommunications for over forty years, having joined the National Telephone Co. in 1896. He is this year's chairman of the Meter and Instrument Section of the Institution of Electrical Engineers. An account of his career was published in our issue of October 21st last year.



Capt. B. S. Cohen

The annual dinner and dance of the employés of the Edison Swan Electric Co., Ltd., was held recently at the company's Ponders End works. The function, which was the first organised by the re-formed Ediswan Social Club, was attended by **Mr. F. V. Hasemore,** director and secretary.

Mr. W. I. Paul was married recently to Miss Edith Dorothy Edwards at the Wesleyan Church, Blackwood. Mr. Paul is with the West Cambrian Power Co., Ltd., at Carmarthen, and was formerly on the showroom staff of the Gellygaer U.D.C. Electricity Department.

Mr. E. P. Naden has been appointed deputy resident engineer and manager of the Electricity Co. of Macclesfield, Ltd. He joined the company as a pupil eighteen years ago, and has been connected with all the departments of the company in its development.

Mr. G. V. Harrap, of the Hull Corporation Electricity Department, has taken up the position of technical assistant with the West Ham Corporation Electricity Department. He served his apprenticeship with the Metropolitan-Vickers Electrical Co., Ltd., was awarded a scholarship by that company to Manchester University, and in 1928 he was engaged on switchgear and transformer contracts. In 1930 he joined the Dundee Corporation Electricity Department to deal with substation operation and design, and three years later joined the Northern-Eastern Electric Supply Co., Ltd., with whom he was engaged on the construction of the new Dunston "B" station. He left Newcastle in 1936 to take up a position on the technical side of the Hull Corporation electricity undertaking. He was section secretary at Dundee and Hull, and assistant secretary at Newcastle for the E.P.E.A., and has served on I.E.E. Students' Committees. He has read four papers before I.E.E. students, two of which have received premiums. Mr. Harrap has been a frequent contributor to the ELECTRICAL REVIEW.

Mr. D. McNicoll, B.Sc., has been appointed export sales manager to British Timken, Ltd. This is a new post created to assist in the management of the export business of the company. Mr. McNicoll's engineering experience has been gained both in England and abroad, and since joining British Timken, Ltd., in 1934, he has travelled widely for the company in Europe, as well as in Turkey, Palestine, Egypt, Iraq and India.

Several changes have been made in the organisation of the Simplex Electric Co., Ltd. **Mr. F. N. Pardow,** for a number of years manager of the Liverpool branch, has been appointed a director of the associated company, Mersey Cable Works, Ltd.; **Mr. L. G. Harris** is transferred from the London branch, and succeeds Mr. Pardow as Liverpool district manager; **Mr. W. Arthur,** hitherto assistant manager of Mersey Cable Works, Ltd., has been appointed to the head office of Simplex Electric Co., Ltd., as manager, cable sales.

Dr. R. L. Smith-Rose has been appointed Superintendent of the Radio Department of the National Physical Laboratory, which includes the Radio Research Station at Slough in addition to the section of the Department at Teddington, as from January 1st. Dr. Smith-Rose joined the staff of the N.P.L. in 1919 as a member of the Electricity Department and later he formed the nucleus of the wireless division of that Department, conducting investigations on thermionic valves, radio reception and direction-finding under the auspices of the Radio Research Board established under the Department of Scientific and Industrial Research. Later research included the measurement of the electrical constants of the ground and their influence on the propagation of waves, and much of this work has recently been extended into the ultra-short band of wavelengths below 10 metres. Following the formation of the Radio Department of the N.P.L. in 1933 Dr. Smith-Rose became principal scientific officer under Mr. R. A. Watson Watt as Superintendent; and he has been in charge of both the Teddington and Slough divisions of the Department since Mr. Watson Watt left the laboratory in 1936 to take up a position in the Air Ministry.

Mr. Ernest E. Sharp, the president of the Electrical Industries Benevolent Association, was to sail for the West Indies on Wednesday last to recuperate after a severe attack of arthritis and neuritis. We hope that his trip will fully restore him to health and his activity on behalf of the E.I.B.A. Mr. H. Senior Fothergill, the secretary of the Association, tells us that the income during Mr. Sharp's year of office has broken all records.

Mr. Frank Parkinson, chairman of Crompton Parkinson, Ltd., and donor of £250,000 to Leeds University, is to receive the honorary degree of Doctor of Laws on January 17th on the occasion of the installation of the Duke of Devonshire as Chancellor of the University in succession to his late father. Mr. Parkinson was himself educated at Leeds University and is now a member of the Board of Governors.

Mr. G. H. Nisbett has been elected deputy-chairman of the board of British Insulated Cables, Ltd.; he will retain his position of managing director. **Mr. T. A. Eades,** managing director, Automatic Telephone & Electric Co., Ltd., has been appointed a director of the company.

On January 7th the B.T.H. Willesden Works entertained 423 children at the annual Christmas party. The scene of the festivities was the works canteen, which was gaily decorated by members of the Sports Club (entertainments section) who were responsible for the complete organisation. Tea concluded, the small guests were entertained by various artists on the B.T.H. staff and also a selection of cartoon films, the projector being lent and operated by Sound & Cinema Equipment, Ltd. The entertainment ended with the appearance of Father Christmas with toys for all, including 144 dolls, dressed by lady members of the staff, prizes being awarded for the best-dressed dolls by Mrs. Hands (wife of Mr. T. Hands, manager B.T.H., Willesden). Following the party an informal social and dance was held, to the music of the Apprentice Association band.

Sales representatives and staff of Hoover, Ltd., from all parts of Great Britain and the Continent, with their wives and friends, filled the Royal Albert Hall to overflowing on January 4th for what was probably the largest New Year party in the country. Some of the guests travelled from as far afield as Belgium, France and Switzerland. This year's event was the largest party the company has ever held, and Mr. W. M. Tribute, the sales promotion and advertising manager who organised the party, also arranged an excellent cabaret show.

OBITUARY

Mr. A. S. Blackman.—We regret to record the death of Mr. Alfred Southerland Blackman, late borough electrical engineer and manager to the Sunderland Corporation, which occurred on January 8th at Surbiton, at the age of sixty-nine. Mr. Blackman received his education at a private school at Oxford and served his apprenticeship with Crompton & Co., Chelmsford. In 1892 he secured a position with the Hove Electric Lighting Co., Ltd., and two years later was appointed city electrical engineer at Aberdeen. He became borough electrical engineer and general manager at Poplar in 1898 and was appointed city electrical engineer at Bradford in 1903. In 1907 he took up the position of borough electrical engineer and general manager at Sunderland, where he remained until his retirement in December, 1934, having completed forty years' management of municipal electricity undertakings. For several years he served upon the council of the I.M.E.A., of which he was a vice-president, but he declined the presidency. He had also served upon the executive committee of the Associated Municipal Electrical Engineers from its inception, and had been president and hon. secretary, and latterly was one of the two joint trustees of the organisation.

Mr. A. F. Harmer.—We regret to learn that Mr. A. F. Harmer, chief electrical engineer and manager of the Hammersmith Corporation Electricity Department for the past five years, died on Wednesday last. A note on his career will appear in our next issue.

Mr. G. Herbert.—The death occurred on January 5th of Mr. George Herbert, general manager of the Craigpark Cable Co., Ltd., Glasgow.

Mr. H. D. Lewis, who was responsible for the preparation and supervision of the work of converting Portsmouth's horse tramway system to electricity in 1901, died last week. He retired from his position of permanent way engineer to the Corporation in 1929 after thirty-three years' service.

Mr. E. A. Walsh.—We regret to announce the death on Tuesday of Mr. Edward A. Walsh, for the past five years sales manager for power cables with the Telegraph Construction & Maintenance Co., Ltd.

Mr. J. R. Wragg.—The death occurred recently at the early age of twenty-six of Mr. J. R. Wragg, son of the chairman of the Mexborough U.D.C. Electricity Committee, and a member of the staff of the electricity undertaking.

The British Industries Fair

List of exhibitors

JUDGING from the list of exhibitors of electrical and allied products published below, the British Industries Fair, which is to be held this year from February 20th to March 3rd, should prove as comprehensive and attractive as ever. Most of the Castle Bromwich (Birmingham) exhibitors mentioned will appear in the Electrical Section (Cb), the remainder being found in the Hardware (A), Building (B), Gas (Ca) and Engineering (D) Groups. Except for the few Earls Court stands indicated all the London exhibitors will be at Olympia.

Birmingham

Accles & Pollock, Ltd. ... ... D 510
Ace Electric Co. ... ... Cb 113
Aeraspray Mfg. Co. Ltd. ... D 722
Aerograph Co., Ltd. ... ... D 227
Aiton & Co., Ltd. ... ... Cb 620
Allday, Wm., & Co., Ltd. ... Ca 609
Allen, Edgar, & Co., Ltd. ... D 719
Ashdown, Ltd. ... ... Cb 311
Avery, W. T., Ltd. ... ... D 412 & 515
Avery-Hardoll, Ltd. ... ... D 412 & 515
Babcock & Wilcox, Ltd. ... ... D 300 & 401
Bakelite, Ltd. ... ... Cb 408
Baldwins, Ltd. ... ... Cb 222
Bank Hardware Mfg. Co., Ltd. ... A 224 & 329
Banks, Harry J., & Sons ... Cb 125
Barker & Turner, Ltd.... ... Ca 708
Beetle Products Co., Ltd. ... ... Cb 506 & 607
Belling & Lee, Ltd. ... ... Cb 702
B.E.N. Patents, Ltd. ... ... B 627
Berry's Electric, Ltd. ... ... Cb 209
Birmingham Battery & Metal Co., Ltd. D 506 & 607
Birmingham Electric Furnaces, Ltd.... Cb 214 & 313
Birmingham Electric Supply Dept. ... Cb 406
Black & Decker, Ltd. ... ... Cb 511
Blackwell, W., Oil Co. ... ... Cb 201
Bliss, E. W., & Co. ... ... Cb 615
Bowker, S. O., Ltd. ... ... Cb 317
Bratt Colbran, Ltd. ... ... Cb 617
Bray, Geo., & Co., Ltd. ... Cb 305
Britannia Batteries, Ltd. ... Cb 608
Britannia Tube Co., Ltd. ... D 611
British Aluminium Co., Ltd. ... ... D 514 & 615
British Elec. Domestic Appliances (1938), Ltd. ... ... Cb 711
British Elecl. Development Assoc., Inc. Cb 306 & 407
British Industrial Plastics, Ltd. ... Cb 506 & 607
British Mechanical Productions, Ltd ... Cb 312
British Oxygen Co., Ltd. ... ... D 312 & 411
British Thermostat Co., Ltd. ... ... Cb 700
British Thomson-Houston Co., Ltd. ... Cb 404 & 505
British Trane Co., Ltd. ... ... B 321
British Vacuum Cleaner & Engineering Co., Ltd. ... ... Cb 205
Brook, J. A., Ltd. ... ... Cb 704
Bulpitt & Sons, Ltd. ... ... A 417 & Cb 516
Burco, Ltd. ... ... Cb 315
Butcher, J. H., & Co., Ltd. ... ... B 423
Cable Makers' Assen. ... ... Cb 300 & 401
Canning, W., & Co., Ltd. ... ... Cb 118 & 215
Cardiff Corporation Development Cttee. A 500 & 601
Carron Company ... ... Cb 721
Carter, H. W. & James, Ltd. ... ... A 608
Cellactite & British Uralite, Ltd. ... B 522 & 623
Cellon, Ltd. ... ... B 529
Chloride Elec. Storage Co., Ltd. ... Cb. 307
Clarkson Thimble Tube Co., Ltd. ... D 300 & 401
Coates & Son ... ... Cb 119
Cole, E. K., Ltd. ... ... Cb 611
Constructors, Ltd. ... ... Cb 508 & 609
Cotto Products ... ... Cb 705
Coventry Machine Tool Works, Ltd.... D 524
Daniels, T. H. & J., Ltd. ... ... Cb 724
Delta Metal Co., Ltd. ... ... D 301
Deritend Stamping Co., Ltd. ... ... D 418
Desoutter Bros., Ltd. ... ... Cb 403
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Dixon, R. G., & Co., Ltd. ... ... Cb 713
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Donovan Elec. Co., Ltd. ... ... Cb 309
Dorcam, Ltd. ... ... Cb 710
Drew, Clark & Co. ... ... A 226
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Elliott, E., Ltd.... ... ... Cb 413
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E.R. Co. ... ... Cb 206
Erith's Engineering Co., Ltd. ... ... D 300 & 401
Ether, Ltd. ... ... Cb 716
Evenlite Tube Lamp Developments, Ltd. ... ... Cb 110
Firth Co., Ltd. ... ... Cb 216
Fitz-Gibbon & Murray, Ltd. ... ... Cb 111
French, W. T., & Son, Ltd. ... ... A 433
Fusarc Welding Co., Ltd. ... ... Cb 717
Gascoignes (Reading), Ltd. ... ... D 733
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Gent & Co., Ltd. ... ... Cb 513
Gilman, F. (B.S.T.), Ltd. ... ... Cb 518
Girdlestone & Co. ... ... D 323
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Greenwood & Batley, Ltd. ... ... D 212 & 313
Grosvenor Utilities, Ltd. ... ... Ca 707
Guest, Keen & Nettlefolds, Ltd. ... B 524
G.W.B. Electric Furnaces, Ltd. ... Cb 204 & 303
Hague & McKenzie, Ltd. ... ... Cb 400
Hall, B. J., & Co., Ltd. ... ... D 727
Harland Engineering Co., Ltd. ... Cb 503
Harvey, G. A., & Co. (London), Ltd. B 327
Hawkes, O. C., Ltd. ... ... B 407
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Higgs Motors, Ltd. ... ... Cb 619
Holden, A. N., & Co., Ltd. ... ... Cb 109
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Horstmann Gear Co., Ltd. ... ... Cb 610
Hotpoint Electric Appliance Co., Ltd. Cb 507
Hufton, Chas., & Sons, Ltd. ... ... A 414
Hurley Machine Co. (England), Ltd.... Cb 709
I.C.I., Ltd. (Degreasing) ... ... D 305
I.C.I., Ltd. (Heat Treatment)... ... D 204
I.C.I. Metals, Ltd. ... ... D 302 & 403
Iddon, Victor H., Ltd. ... ... Cb 127
International Combustion, Ltd. ... D 222 & 321
Ivor Power Speciality Co., Ltd. ... D 218
Izons & Co., Ltd. ... ... A 515
Jackson Electric Stove Co., Ltd. ... Cb 409
Johnson, Matthey & Co., Ltd. ... Cb 308
Johnson, Richard, & Nephew, Ltd. ... B 514
Kaufmann, H., Ltd. ... ... A 502 & 603
Kitchendom, Ltd. ... ... A 527
Lacrinoid Products, Ltd. ... ... A 628
Lan-Bar, Ltd. ... ... A 425
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Ley's Malleable Castings Co., Ltd. ... D 402 & 503
Lister, R. A., Ltd. ... ... D 202
Logan, F. R., Ltd. ... ... Cb 109
London Aluminium Co., Ltd. ... ... A 310 & 411
Lorant & Co., Ltd. ... ... Cb 714
Lucas, Joseph, Ltd. ... ... Cb 501
Lusty, W., & Sons, Ltd. ... ... A 622
MacGregor & McCallum, Ltd.... ... Cb 112
Maclaren, Robert, & Co., Ltd. ... Cb 115
Macpherson, Donald, & Co., Ltd. ... B 527
Mansions Motor Co., Ltd. ... ... D 710
Mason, A., & Sons, Ltd. ... ... B 500
Mavor & Coulson, Ltd. ... ... D 620
M.C.L. & Repetition, Ltd. ... ... D 406
Metalectric Furnaces, Ltd. ... ... Cb 504 & 605
Metlex Industries, Ltd. ... ... A 512
Midland Fan Co., Ltd. ... ... A 612
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Moss Gear Co., Ltd. ... ... D 420
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Newall's Insulation Co. ... ... D 521
Newton, L. H., & Co., Ltd. ... ... D 224
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Omes, Ltd. ... ... D 419
Ormerods (Coventry), Ltd. ... ... D 105a
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Peace, Henry, Ltd. ... ... Cb 612
Peglers, Ltd. ... ... B 421
Perkins Clean Milk Equipment, Ltd.... A 621
Permaheat (Permavox), Ltd. ... ... Cb 718
P. & H., Ltd. ... ... Cb 501
Pinchin, Johnson & Co., Ltd. ... B 516 & 617
Pitter Gauge & Precision Tool Co., Ltd. Cb 312
Poles (1938), Ltd. ... ... Cb 508 & 609
Power Centre Co., Ltd. ... ... Cb 612
Prior Burners, Ltd. ... ... B 202 & 303
Pyrotenax, Ltd. ... ... Cb 712
Rapid Magnetting Machine Co., Ltd. Cb 412
Rawlplug, Ltd. ... ... Cb 210
Redmanol, Ltd. ... ... Cb 408
Revo Electric Co., Ltd. ... ... Cb 304 & 405
Rheostatic Co., Ltd. ... ... Cb 310 & 411
Riley Stoker Co., Ltd. ... ... D 222 & 321
Robbins & Bradley ... ... Cb 500
Rotax, Ltd. ... ... Cb 501
Rowlands Electrical Accessories, Ltd. Cb 102 & 103
Rozalex, Ltd. ... ... Cb 722
Rubery Owen & Co., Ltd. ... ... D 602 & 703
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S. & D. Rivet Co. ... ... D 704
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Sellman & Hill, Ltd. ... ... A 202 & 307
Serck Tubes, Ltd. ... ... D 608
Simmonds Aerocessories, Ltd. ... D 421
Simmons Holloware Co., Ltd. ... A 305
Simplex Electric Co., Ltd. ... ... Cb 314 & 415
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Small, W. R., Ltd. ... ... Cb 706
Smellie, James, Ltd. ... ... B 519
Smith Meters, Ltd. ... ... Cb 100 & 203
Sordovisor, Ltd. ... ... Cb 220
Sperryn & Co. ... ... Ca 508
Spiral Tube & Components Co., Ltd.... D 713
S.S. Offset, Ltd. ... ... Cb 109
Standard & Pochin Bros., Ltd. ... B 420
Stein, John G., & Co., Ltd. ... ... D 303
Sterling Cable Co. ... ... Cb 117
Stewarts & Lloyds, Ltd. ... ... D 400 & 501
Stirling Boiler Co., Ltd. ... ... D 300 & 401
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Taylor, Chas. (Birmingham) Ltd. ... D 612
Taylor & Challen, Ltd.... ... ... D 409
Taylor, Law & Co., Ltd. ... ... Cb 319
Tecalemit, Ltd. ... ... D 316 & 415
Teddington Controls, Ltd. ... ... Cb 700
Telsen Electric (1935), Ltd. ... ... Cb 106
Terry, Herbert, & Sons, Ltd. ... ... B 424
Thomas, Bertram ... ... Cb 321
Thompson, John (Wolverhampton) Ltd. D 410 & 513
Timmis & Co., Ltd. ... ... Cb 603
Titanine, Ltd. ... ... Cb 606
Treforest Trading Estate ... ... A 500 & 601
Tube Products, Ltd. ... ... D 517
Tubes, Ltd. ... ... D 508 & 609
Tudor Manufacturing Co. ... ... Cb 119
Turner Bros. (Birmingham), Ltd. ... D 223
Turners' Asbestos Cement Co. ... Ca 301
United Steel Companies, Ltd.... ... D 512 & 613
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Waddicor (Bradite), Ltd. ... ... Cb 208
Wakefield, C. C., & Co., Ltd. ... ... Cb 301
Walker, Jas., & Co., Ltd. ... ... D 422
Ward, H. W., & Co., Ltd. ... ... D 315
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Whyte & Collins ... ... B 500
Wild-Barfield Electric Furnaces, Ltd. Cb 204 & 303
Wilkins & Mitchell ... ... Cb 604
Williams (Birmingham), Ltd. ... ... A 312 & 413
Williams, John, & Sons (Cardiff), Ltd. A 312 & 413
Winn & Coales, Ltd. ... ... Ca 206
Wolseley Sheep Shearing Machine Co., Ltd. ... ... D 705
Yorkshire Copper Works ... ... B 632 & 723
Zinc Alloy Rust Proofing Co., Ltd. ... D 732

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A.B.E.C., Ltd. ... ... D 1141
Abrahams & Co. ... ... D 1120
Anstey & Wilson, Ltd. ... ... E 1246
"Ardente," Ltd. ... ... A 699 & 704
Ashdown, H. E. (Birmingham), Ltd. A 741
Baird & Tatlock (London), Ltd. ... A 685 & 698
Bakelite, Ltd. ... ... A 763 & 769
Baker, Charles ... ... A 663
Baker Platinum, Ltd.... ... ... E 1212
Barr & Stroud, Ltd. ... ... A 683
Beatty Bros. Ltd. ... Earls Court 243 & 244
Belgrave Electric Co., Ltd. ... ... F 1376
Bellingham & Stanley, Ltd. ... ... A 657
Binger, O. D. (Sales Aids), Ltd. ... D 1121
British Alabaster & Arts Co.... ... G 1531
British Electric Domestic Apps., Ltd. H 1654
British Plastics Federation, Ltd. ... A 773
British Vacuum Cleaner Eng. Co., Ltd. D 1137 & H 1655
Bylock Electric, Ltd. ... ... H 1666
Cable & Wireless, Ltd. ... ...Earls Court 219
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Casella, C. F., & Co., Ltd. ... ... A 658
Cole, E. K., Ltd. ... ... A 756
Crystal Glass Co. ... ... C 1059
De la Rue, Thos., & Co., Ltd. ... A 744, 755 & 802
Dent, R. H., Ltd. ... ... A 699 & 704
Dernier & Hamlyn, Ltd. ... ... F 1395
Dictograph Telephones, Ltd. ... A 784
Dominion Electrical Co. ... ... D 1122
Doughty, J. M., & Sons, Ltd. ... Earls Court 144
Ebonestos Insulators, Ltd. ... ... A 743
Econasign Co., Ltd. ... ... B 980
Electric Art Shades (1928), Ltd. ... F 1353
Elliott, F. W., Ltd. ... ... D 1142
Elliott & Spear, Ltd. ... ... F 1360
Enfield Clock Co. (London), Ltd. ... D 1126 & 1129
English Clock & Watch Mfrs., Ltd.... D 1141
Erinoid, Ltd. ... ... A 740 & 759
Foster, A. E. ... ... F 1416
Franklin Lamp Mfg. Co., Ltd. ... F 1343
Garrard Clocks, Ltd. ... ... D 1135
General Chemical & Pharmaceutical Co., Ltd. ... ... A 671
General Post Office, ... Earls Court 218
Glazart, Ltd. ... ... F 1423
Grimshaw, Baxter & J. J. Elliott, Ltd. D 1139
Hanovia, Ltd. ... ... A 682
Hilger, Adam, Ltd. ... ... A 679
Hoover, Ltd. ... ... H 1665
Hughes, F. A., & Co., Ltd. ... ... A 760 & 775
Hyders, Ltd. ... ... F 1414
Ideal Home Elec. Appliances, Ltd. ... A 700
Imperial Chemical Industries, Ltd. ... A 627 & 640
Insulators, Ltd. ... ... A 761
Jaffe & Rose ... ... F 1344
Jobling, James A., & Co., Ltd. ... A 801
Johnson, Matthey & Co., Ltd. ... D 1236 & 1240
Kalee, Ltd. ... ... A 686
Kent Mouldings ... ... A 770
K.F.M. Engineering Co., Ltd. ... D 1131
Kitchendom ... ... Earls Court 424
Leek, E. & J., Ltd. ... ... E 1232
Lusty, W., & Sons, Ltd. ... ... F 1365 & Earls Court 178
Mallinson & Eckersley, Ltd. ... ... G 1533
Mayfair Shades, Ltd. ... ... F 1413
New Welbeck, Ltd. ... ... H 1656
Ozonair, Ltd. ... ... A 660
Pepper, Arthur J., & Co., Ltd. ... D 1117
Perivale Clock Mfg. Co., Ltd. ... D 1127
Perry Bevan & Co., Ltd. ... ... E 1219
Reliance Rubber Co., Ltd. ... ... A 719
Salter, Philip ... ... F 1420
Schick Dry Shaver (England) Ltd. ... E 1220
Shelley Potteries, Ltd. ... ... C 1026 & 1049
Smith's English Clocks, Ltd.... ... D 1141
Stadium, Ltd. ... ... G 1541
Stanley, W. F., & Co., Ltd. ... ... A 676
Thermega, Ltd. ... ... A 702
Waite & Son, Ltd. ... ... F 1345
Walker Fender Co., Ltd., ... Earls Court 186
Webb's Crystal Glass Co., Ltd. ... A 811
Webber, P., Ltd. ... ... F 1397

COMMERCIAL AND INDUSTRIAL NEWS

E.C.A. Reconstitution. A Works A.R.P. Scheme. Japanese Lamp Industry. The Kingston Fire. Food Factory Installation. Electricity in Aircraft.

Reconstitution of the E.C.A.

THE structure of the Electrical Contractors' Association has just been put through a process of strengthening and extension to ensure more effective representation of members. The number of members of the Council has been reduced from 50 or more to 31. Elections to the Council are made by the sectional boards. The latter have been increased from six to eleven covering the following areas: London and Home Counties; Eastern Counties; Southern Section; South-Eastern Section; South-Western Section; South Wales; Western Counties; Midland Counties; North-Western Counties; Northern Counties; and Irish Section. A greatly increased number of members have been elected to these boards by the branches so that a much greater proportion of the membership will have an active share in managing the affairs of the Association. At least once a year each board will organise a "regional conference" to enable members to meet the President and Director.

An A.R.P. Scheme

Higgs Motors, Ltd., have just completed an extensive scheme for air-raid shelters for their workpeople. This scheme employs a new system of concrete shelters which are believed to be the first of their kind in the Midlands and the cost,

An A.R.P. shelter under construction at the Witton works of Higgs Motors, Ltd.

proportionate to the protection given, is extremely low. The number of employés at these works is between 600 and 700. Provision has been made to accommodate approximately 500 people. It is expected that a number of employés who live adjacent to the works will naturally wish to go home in the event of an air raid. Four trenches have been dug, each accommodating 120 persons. The total cost is nearly £350, or about 14s. per person, which is an extremely low figure for this class of shelter. The shelters have been built with precast concrete interlocking members. Grooved upright posts are slotted into concrete base blocks and wall slabs are fitted into the grooves. The uprights are then joined by reinforced concrete beams 6½ in. thick. Concrete is not laid on the floor between the cross-pieces, but duckboards are provided. The finished size of the shelters is approximately 7 ft. square and each shelter is 60 ft. long. The top of each shelter is covered with 3 ft. of earth and it is intended at a later date to provide further protective covering. The entrance to each trench is guarded by sandbags and provision is being made to install an air filtration plant. Our picture shows the concrete portion of the shelter finished before the covering layer of earth has been added. Part of the River Tame runs through the company's property and there is usually an ample supply of water in this river. The company has therefore purchased a large auxiliary fire engine driven by a petrol engine for use in case of fire from incendiary bombs when the main supply is cut off.

The Kingston Fire

In a communication regarding the recent fire at the Kingston power station Mr. P. F. Stritzl, technical manager of the A.E.G. Electric Co., Ltd., suggests that had the neutral point of the 11-kV system been earthed through a Petersen coil, the fault current would have been reduced to so low a value as to make it harmless or, alternatively, the use of oil-less circuit-breakers, even with a solidly-earthed neutral, would have eliminated the risk of fire or explosion.

He reminds us that in 1926 Professor Petersen first investigated the possibility of eliminating oil from high-voltage switchgear. Initially it was not clear whether the gas required for the extinction of the arc should be stored as such (air-blast breaker) or in a liquid form (water breaker). Both types were developed simultaneously, but the advantages appeared to be on the side of the air-blast type, except for small unattended sub-stations, where air-compressing plant might not receive adequate supervision and would introduce an element of complication.

The disadvantages of the water breaker with its limited amount of liquid, which was subject to evaporation, were held to be so important, however, that it has been displaced by a simpler design in which the gas is stored in solid form, the chemical resin breaker. The present position is that air-blast breakers are employed on the Continent generally in attended sub-stations for any voltage between 3 kV and 220 kV and for rupturing capacities of 100 MVA upwards, while chemical resin breakers find their application in unattended sub-stations and industrial plant at voltages up to 22 kV and for rupturing capacities up to 200 MVA.

The inquiry by the Electricity Commissioners into the causes and effects of the fire which occurred at the Kingston-upon-Thames Corporation's power station on December 14th is to be resumed at the Kingston Guildhall on Monday next, January 16th. The inquiry was opened by Mr. Henry Nimmo, chief engineering inspector to the Commissioners, on December 19th and was adjourned after written statements had been put in by the Kingston Corporation, the London and Home Counties J.E.A. and the Central Electricity Board. These statements were dealt with in our issue of December 23rd (p. 894).

The I.M.E.A. Convention

The programme of the annual convention of the Incorporated Municipal Electrical Association at Harrogate (June 5th-9th) will include papers by Mr. A. C. Cramb, Director of E.D.A., on advertising and publicity; Messrs. P. J. Robinson and E. L. Morland on "The Practical Side of Electricity Distribution"; and Councillor A. L. Boddington on "The Financial Aspects of Electricity Supply." The meetings will be held in the Royal Hall. The decision not to hold an exhibition this year has so far not been altered.

Australian Tariff Decisions

Following recent customs decisions articles admitted to Australia free of duty under the British preferential tariff include X-ray tubes, parts and materials for surgical, dental and veterinary purposes; and resistor coils, containing 60 to 80 per cent. nickel and 20 to 40 per cent. chromium, for use in manufacturing electric furnaces. Wire fence controllers (apparatus for converting electricity into a form suitable for charging the wires of electric fences) are subject to a duty of 30 per cent. *ad valorem*.

A Modern Food Factory

The new factory and research laboratories of Bengers Food, Ltd., at Holmes Chapel, Cheshire, are an example of the latest practice in their layout, general design and lighting arrangements. Naturally, the buildings have been planned in such a way as to ensure hygienic cleanliness and absolute purity of the product through the various processes. The main block, containing the offices, laboratories and executive departments, is two storeys high. The manufacturing departments are single-storey, occupying a rectangular site with a centre courtyard, and the usual stores, packing and dispatch sections adjoin them. Walls and floors are tiled or otherwise suitably treated to give a bright and pleasing effect, and the whole of the premises are of steel-framed construction. The lighting throughout is by Siemens gas-filled lamps in Benjamin reflectors of the "Glasteel" and "R.L.M." patterns and Siemens "Sphere" fittings. The lighting of the roadway leading to the main entrance is again an instance of modern

The research laboratories of Bengers Food, Ltd., in which Siemens lamps and Benjamin reflectors are used

methods, being provided by Siemens "Sieray-Dual" lamps in Benjamin reflectors. In the spacious canteen and dining-rooms for members of the staff and workpeople the electrical

equipment of the kitchen includes a Siemens H.350 type cooker. A 25-line private automatic telephone system, also of Siemens manufacture, serves the offices and works. The wiring throughout is on the Siemens "Stannos" system, installed by Drake and Gorham, Ltd. In this the neatness of the cable runs is a feature; although it is a surface system, the position of the wiring is almost invisible unless close inspection is made. The power and lighting cables are of Siemens manufacture, also the general distribution boards with "Zed" fuses throughout. Electricity supply is taken in bulk from the North Wales Power Co. into a sub-station on the site.

Changes of Address

The Secretary for Mines announces that, as from January 2nd, the Chief Inspector of Mines and his headquarters staff, the Health and Safety Division of the Mines Department and the secretariats of the Safety in Mines Research Board and the Board for Mining Examinations will be transferred to Mill House, 87-89, Shaftesbury Avenue, London, W.1. The telephone number will be Gerrard 7391 and the telegraphic address Minindust, Lesquare, London.

The address of the *Telegraph and Telephone Age* is now 66-70, Beaver Street, New York, N.Y.

Japanese Lamp Industry

Interesting figures of the Japanese production of and trade in incandescent lamps have been made public by the Association of Lamp Manufacturers. These indicate that in 1937 total production amounted to 655 million lamps valued at 35,900,000 yen. Of these about 300 million were sold at home and the remainder abroad, the value of home sales being about 25 million yen and that of exports 10,900,000 yen. In this connection it is interesting to notice that the average price of ordinary lamps (not including decorative or miniature lamps) was 7.50 yen for export, but 15.38 yen for home consumption. In discussing the situation of the industry the report points out that up to the beginning of the Chinese war Japanese lamps were making good progress both at home and abroad. Since then the control of raw material imports and the boycott of Japanese goods abroad has seriously affected the industry, which is working to only about 70 per cent. of its capacity.

E.I.B.A. (Northern Counties Area)

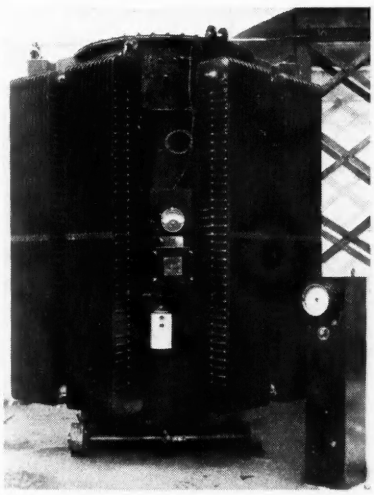
The annual general meeting of the Northern Counties Area of the Electrical Industries Benevolent Association will be held on January 26th at 2.30 p.m. at Tilley's Restaurant, Blackett Street, Newcastle-upon-Tyne, 1, under the chairmanship of Mr. N. S. Tennant.

The E.A.W. Annual Conference

The fourteenth annual conference of the Electrical Association for Women will be held this year in Cardiff from May 3rd to 6th. A civic reception by the Lord Mayor and many other interesting functions are being arranged, and among those who will speak during the conference will be the president of the E.A.W., the Dowager Lady Swaythling, and Dr. A. P. M. Fleming, President of the Institution of Electrical Engineers.

Transformer Progress

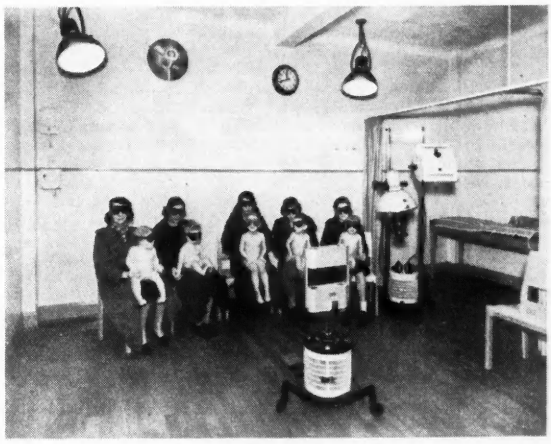
After completion of the order for two 45,000-kVA, 132-kV transformers for the Central Electricity Board (making a total of thirty-two units of this output and over supplied) there are still a number of others under construction by Ferranti, Ltd., of from 10,000 to 20,000 kVA for the 33-kV grid. The two largest transformers on order are two of 87,000 kVA at 66 kV for Battersea power station extensions, while several 40,000-kVA banks at 88 kV and 2,500-kVA three-phase units are required for South Africa. Another aspect of the company's activities is illustrated by the 250-kV testing equipments for three cable manufacturers. By means of high-speed cathode-ray oscillographs direct measurements are being made of surge stresses between turns and coils under lightning conditions. Surge absorbers, which experiments carried out during the year by the N.P.L. and E.R.A. show to flatten both the wave front and wave tail of a surge, are another product of Ferranti's; the flattening of the wave tail is important when a severe surge has been chopped by flash-over of a line insulator or transformer bushing. Practically all large transformers are being fitted with on-load tap-changing gear and the application is being extended with the use of mercury switches to the smaller distribution units where automatic operation is essential. As the tap-changing gear is installed in the main transformer tank no increase in floor space is involved and existing transformers can be readily converted. Moving-coil regulators under construction include those of the self-contained street-pillar and street-pit types and a simple form for the control of small individual loads.



A three-phase regulator giving 20 per cent. voltage range in an 11-kV, 7,500-kVA circuit

An Up-to-date Clinic

Collective irradiation or group treatment is being increasingly adopted in public health and welfare work, since it ensures that a given number of patients can receive uniform and accurate irradiation of the right quality and quantity, within a brief time, at a low cost per patient and in the most convenient and economical manner. The system is now being employed with marked success at the Paddington Borough Council's new Maternity and Child Welfare Clinic at 283a, Harrow Road, W.2, where the equipment installed includes a "Centrosol Model II" self-contained mobile ultra-violet-ray unit and four pendant type "Sollux" infra-red lamps, as well as a duo-therapy unit comprising an "Alpine" u.v. lamp combined with a "Sollux" lamp.



Group ray treatment at the new Paddington Maternity and Child Welfare Clinic [*Elec. Rev.* photo.

Trade with British East Africa

The United Kingdom is maintaining its position as the principal supplier of electrical goods and apparatus to British East Africa (Kenya, Uganda, Tanganyika and Zanzibar). According to the report on economic and commercial conditions just issued by the Department of Overseas Trade (H.M. Stationery Office, 1s. 6d.), the total imports of electrical goods and apparatus increased in value from £114,362 in 1936 to £180,132 in 1937, and of this total the United Kingdom supplied £141,686 (against £93,456 in 1936), Germany £13,502 (£5,237) and the United States £3,037 (£2,568). Imports from the United Kingdom on Government account were valued at £40,839 and included telegraph and telephone instruments and apparatus valued at £18,515.

Out of a total importation of 335,951 electric lamps Japan was responsible for 125,656 and the United Kingdom for 112,333. Imports of radio apparatus (Zanzibar excluded) totalled £39,949 (£29,855 in 1936), of which £15,363 (£7,110) worth came from the United Kingdom, £2,561 (£2,273) from Germany, £6,127 (£3,886) from Holland and £15,315 (£16,250) from the United States. Trade purchases of radio apparatus from the United Kingdom were valued at only £7,830, as the figure £15,363 includes imports on Government account valued at £7,533. Imports of radio receiving sets for private use come mainly from the United States, which supplies as many as all the other countries together. In 1937, however, the United States lost ground, mainly to Holland.

Order for Large Brush Turbo Set

Halifax Corporation has placed an order with the Brush Electrical Engineering Co., Ltd., for a 20,000-kW Brush-Ljungström turbo-alternator costing approximately £70,000.

Sales Conference

A sales conference of David Brown & Sons (Hudd), Ltd., was held at Park Works, Huddersfield, on December 30th. There were about thirty-five people present, including the directors, members of the executive and administrative staffs and all the home representatives of the entire organisation, comprising the parent company, the Penistone works, the Manchester works (P. R. Jackson & Co., Ltd.), and the Lockwood (Huddersfield) works (the Keighley Gear Co.). The day's proceedings started in the morning with a reception in the new reception and exhibition room, which was followed by a tour of the works under the leadership of the various product controllers. The conference itself was opened by Mr. David Brown (managing director), who acted as chairman. Other speakers included Mr. A. Sykes (technical director), Mr.

I. Peel (acting general manager), Mr. A. Avison (general sales manager), Mr. F. W. Rowe (manager of the Penistone works), and heads of the production, engineering and publicity departments. The opportunity was afforded for entertaining the wives of the executives and representatives who had lunch and tea in the board room and spent an interesting hour looking round the works. To round off the day a dinner was held in the evening at the George Hotel, Huddersfield, when about seventy people were present. Notable in the party were Mr. F. E. Brown (governing director), Mrs. F. E. Brown and Messrs. D. Brown, A. Sykes, I. Peel, A. Avison, and F. W. Rowe. After dinner there was an enjoyable entertainment.

A heavy influx of orders, a considerable proportion from abroad, has necessitated extensions and modifications of the works. In this is included the section where "Radicon" double-reduction gears are produced in seventy-two sizes, and ratios up to 10,000 to 1 or more. As worm-geared axles are fitted to every trolley-bus in this country, as well as being embodied in many parts of automobile equipment generally, the activity in this department is understandable.

Other applications are to turbines, rolling mills, winders, and Diesel-locomotive and railcars. Notable among orders from abroad is one for sixteen sets of a new type of co-axial double-helical gear for central-drive tube mills in South Africa; these are required to take a sustained load for 168 hr. per week and deal with starting peaks of two and a half times the normal torque.

The new "Tensor" unit, which consists of a standard single-reduction geared motor with a flange to accommodate any make of motor and is intended for converting line-shaft driven machines to individual drives, is among the products that are keeping the Keighley Gear Co. fully employed.

Ellison Insulations, Ltd.

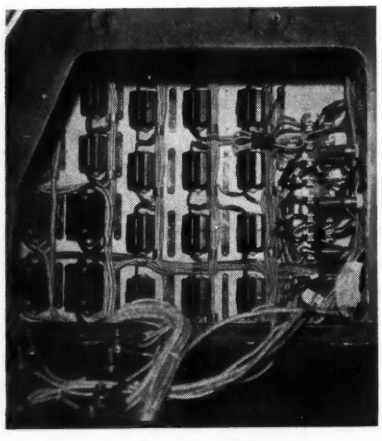
We regret that the name of this company was incorrectly given as "Ellison Insulators, Ltd.," in our last issue.

Vacuum Cleaner Publicity

British Electric Domestic Appliances (1938), Ltd., has sent us an advance leaflet of the 1939 models of "Mary Ann" vacuum cleaners and the "Double-way" automatic electric iron. The company is also issuing a "reward" notice and entry form in which it offers new "Mary Ann" vacuum cleaners to the three owners of the company's vacuum cleaners which have been longest in regular use.

Electricity in Aircraft

The *Albatross*, the latest addition to the Imperial Airways fleet on the London-Frankfort service, takes 2,000 yd. of Callender aircraft cable. Built by the De Havilland Aircraft Co., Ltd., it has four Gipsy 12-cylinder 525 HP engines, and carries a crew of four, and twenty-two passengers and baggage at over 200 miles per hr. with a range of 1,000 miles. The undercarriage, which retracts inwards to the belly of the fuselage, is electrically actuated through irreversible screwjacks. Four electric motors drive the fuel pumps, two (in duplicate) on separate electrical circuits supply both the outboard engines and two, also on separate circuits, supply the inboard engines. The whole electrical system is screened and ducted, and any fuse can be changed during flight. A master cut-out switches off all the main circuit except the motors for the petrol pumps. Each of the two generators driven by the outboard motors can be coupled in flight to one or both of the main circuit accumulators. The radio equipment comprises fixed trailing aerials, two-way communication, direction-finding apparatus, ultra-short-wave blind-approach receivers, a vertical aerial for blind approach inside the radio mast, and fore and aft aerials inside the fuselage away from metallic screening. In the cabin are loud speakers and individual plug-in headphones for each passenger, which enable radio transmission and reception to be continued after flight. Electrically operated flaps have fingertip control (on the control panel) and a visual position indicator. Hot drinks and all meals can be served from an electrically equipped kitchen.



Switches and indicators in the control cabin of the new "Albatross" Imperial Airways 'plane

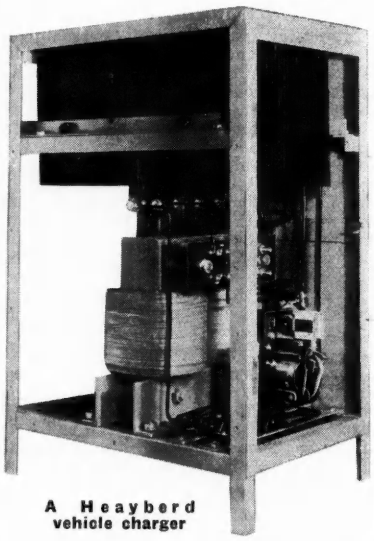
British Standard for Appliances

A new publication of a general character has been issued by the British Standards Institution under the title "British Standard Minimum Requirements for Electrical Appliances and Accessories (excluding those covered by other British Standards)," the title implying that the document is not a British Standard Specification in the usual sense of the word.

It is divided into two parts, dealing with general and specific requirements. Under "General Requirements" are included: Insulation; provision for earthing; prevention of accidental contact; mechanical hazards; connections for flexible conductors; insulation resistance; high-voltage tests; surface temperatures, &c. In the section on specific requirements are included a number of clauses constituting a test specification for tumbler switches, and others on electrode boilers (pressure- and temperature-limiting devices) and cooking apparatus. This British Standard (No. 816—1938) is intended for the use of all those concerned with the design, manufacture, or purchase of such electrical appliances and accessories as are not already covered by current British Standard Specifications. Copies may be obtained from the British Standards Institution at 2s. 2d., post free.

Low-voltage Lighting and Battery Charging

The trend towards the use of low voltages for portable lamps is illustrated at the works of F. C. Heayberd & Co., where double-wound transformers rated at from 60 to 750 W for stepping down the mains voltage to 12, 25 and 50 V are being made in these types according to the accessories required. The secondary winding is centre-tapped and taken to an earth terminal, to which is also connected the shield between the two windings, and the whole is built in steel cases for wall or bench mounting. All of the twenty-four models of battery-charging equipment made by this concern, from 1-A upwards, incorporate metal rectifiers and provide for voltage and current regulation by snap-action rotary switches connected to taps on the transformer. There are also eighteen types of automatic metal rectifier equipment for charging up to thirty 2-V cells at 40 A for battery vehicles and five non-automatic types for hand trucks.



A Heayberd vehicle charger

German Radio Industry

The Reich Economic Minister has now removed the restrictions which have existed for several years on the starting by new concerns of the production of radio receiving sets, amplifiers and loudspeakers, as the conditions which brought about the restrictions no longer exist. The restrictions on the extension of the production and of the capacity of existing works in the case of radio valves have been prolonged until the end of 1939.

Change of Name

In accordance with the terms of sale of their electric lamp business, John Ismay & Sons, Ltd., have changed the name of the company to Sterling Electric Holdings, Ltd. The Board of Trade objected to the name originally proposed in the notice, Sterling Holdings, Ltd.

Trade Announcements

The Simplex Electric Co., Ltd., has opened a new service depôt at 15, St. George Street, Norwich (telephone: Norwich 3344; telegraphic address: Simplex, Norwich), where representative stocks of the company's products will be available.

Stanelco Products, which has recently opened offices at 163, Great Portland Street, London, W.1, is an offshoot of Standard Telephones and Cables, Ltd. This new organisation will carry out the marketing and eventual manufacture of refrigerating and air conditioning equipment, also portable electric tools of all types, temperature and pressure control instruments, switchgear, &c. The general manager of Stanelco Products is Mr. A. McVie, who has been well known as the foreign director of Standard Telephones and Cables, Ltd.

Calendars, Diaries, etc.

A neat little pocket diary has been received from the Arora Co. This is bound in dark blue leatherette with a quick-reference index card.

The large monthly sheets of the wall calendar sent to us by W. H. Stone & Co. (Cardiff), Ltd., show preceding and following months.

The diary received from the Key Engineering Co., Ltd., is

bound in dark blue morocco leather and contains a considerable amount of useful electrical data. There are also sixteen pages of road maps of Great Britain.

Prices of Materials

Henry Gardner & Co., Ltd., report, January 11th: Copper bars (best selected), sheet and rod, no change. English pig lead, £16 15s., 5s. decrease. Spelter, £13 8s. 9d., 5s. decrease. English block ton, £216 10s., 15s. decrease. Mercury, £15 4s., 4s. increase.

Frederick Smith & Co. report, January 11th: Electrolytic copper bars, £49 10s., £1 5s. decrease. Ditto, ditto, wire rods, £54 5s., £1 5s. decrease. Ditto, ditto, h.c. wire, 7⅛d., ¼d. decrease. Silicium bronze wire, 8¾d., ¼d. decrease.

Edward Till & Co. report, January 11th: India-rubber, Para fine, no change.

New Catalogues and Lists

F. C. Blackwell & Co., Ltd., Great Crosby, Liverpool, 23.—A catalogue of "Blaco" conduit fittings.

Metropolitan Electric Supplies, Exchange House, Old Change, London, E.C.4.—A price list of iron elements, spirals and spare parts for electric fires.

G. Turnock, Ltd., 41, High Street, Aston, Birmingham, 6.—A catalogue of "Tunion" accessories.

Switchgear & Equipment, Ltd., Banbury.—A calendar blotter illustrating "SE" extensible metalclad switchboards.

J. H. Tucker & Co., Ltd., King's Road, Tyseley, Birmingham, 11.—A leaflet dealing with shuttered socket outlets.

Restlight, Ltd., 16, Doughty Street, London, W.C.1.—A booklet describing the "Restlight" and "Lamplough" matching lamp.

Marconi-Ekco Instruments, Ltd., Electra House, Victoria Embankment, London, W.C.2.—A leaflet on "Noise Measurement."

Marelli & Co., Ltd., Artillery House, Artillery Row, Victoria Street, London, S.W.1.—Leaflet SM/489 dealing with a range of fractional h.p. geared motors for a.c. and d.c. supplies.

Crofts (Engineers), Ltd., Thornbury, Bradford.—A catalogue of 150 pages describing the company's stock V-rope drives.

Venner Time Switches, Ltd., Kingston By-pass Road, New Malden, Surrey.—A new publication describing a programme ringer.

Electricity Services, Ltd., 86, Cannon Street, London, E.C.4.—An unusual packet of blotters with amusing rhymes and sketches on the front relating to the "Typerlite" fitting.

Bankruptcy Proceedings

O. G. Lamb, 26, St. George's Road, Great Yarmouth, electrician.—The public examination was held at the Town Hall, Great Yarmouth, on January 2nd, when it was reported that there were gross liabilities of £140, of which £126 was expected to rank for dividend. There were no net assets. The examination was closed.

J. Stubbs and **J. A. P. Boulton** (John Stubbs & Co.), electrical engineers, 39, Bootham, York.—Receiving order made December 23rd on a creditor's petition. First meeting January 16th at Lantern Tower Chambers, Coppergate, York. Public examination January 19th at the Law Courts, York.

C. R. Miskin (Miskin & Rice), electrical contractor, Bush House, Aldwych, London, W.C.2, lately carrying on business at 31, Windmill Street, London, W.1.—Application for discharge to be heard on January 27th at Bankruptcy Buildings, Carey Street, W.C.2.

R. W. Burrows, radio and electrical engineer, High Street, Skegness.—Trustee, Mr. E. C. Midgley, 1, St. Swithin's Square, Lincoln, Official Receiver, released December 22nd.

J. T. Southwood, electrical engineer, 13, Brandreath Road, Compton, Plymouth.—Trustee, Mr. A. N. F. Goodman, 11, St. Aubyn Street, Devonport, Plymouth, Official Receiver, released December 30th.

R. Corbett and **I. A. J. Merritt** (Corbett and Merritt), electrical and radio engineers, 2b, Junction Road, Andover.—Trustee, Mr. H. T. Jones, 12, Rolleston Street, Salisbury, Official Receiver, released December 30th.

Company Liquidations

Western Lamps, Ltd.—Winding up voluntarily. Liquidator, Mr. P. J. Marriage, 14, Aldgate, London, E.C.3.

British Rola Co., Ltd.—Winding up voluntarily for reconstruction purposes.—Liquidator, Mr. F. H. Harper, 3, Clement's Inn, London, W.C.2. (The registration of a new company called British Rola, Ltd., is recorded in our "New Companies" section.)

A. C. Baker, Ltd.—Meetings February 6th at 14, Moorgate, London, E.C.2, to receive an account of the winding-up by the liquidator, Mr. L. C. E. Webber.

John Stubbs Industries, Ltd., York.—Meetings of creditors and contributories January 16th at the Official Receiver's Office, Lantern Tower Chambers, Coppergate, York.

British Permel Enamelled Wire, Ltd.—Particulars of claims by February 20th to the liquidator, Mr. A. B. Adam, Victoria Works, Charlton, S.E.7.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

LODESTAR fittings.
CLEVELAND KLEENCUT mincer.
BEDFORD fire.

Yugoslav Electrical Imports

Increased British share

THERE was an increase of 50 per cent. in the electrical imports of Yugoslavia between 1936 and 1937 and although Germany maintained her predominant position in the trade, Great Britain also obtained a fair share in certain groups. These included power plant, radio-telegraph apparatus and some switchgear. In the electrical trade as a whole Great Britain nearly trebled her trade during the period under review, a trend which was very satisfactory in view of the fact that German standards have been adopted in Yugoslavia. The following table, which is based on the official foreign trade returns, shows the imports of the principal groups in 1937 compared with 1936 (238 dinars = £).

	1937 Dinars (000)	Inc. or dec. on 1936 Dinars (000)
Dynamos, alternators and motors—		
500 to 3,000 Kg.:		
Total	10,878	+ 4,602
From Austria	1,861	− 109
,, Germany	6,956	+ 4,710
,, Great Britain	615	+ 427
,, Czechoslovakia	500	− 239
Over 3,000 Kg:		
Total	13,791	+ 10,827
From Great Britain	922	+ 750
,, Germany	11,798	+ 11,110
Under 500 Kg:		
Total	23,097	+ 8,004
From Austria	4,881	+ 1,012
,, Great Britain	686	+ 380
,, Germany	13,447	+ 5,753
,, Czechoslovakia	1,868	+ 436
Transformers—		
Up to 1,500 Kg.:		
Total	6,108	+ 2,139
From Austria	787	+ 87
,, Great Britain	492	+ 471
,, Germany	3,912	+ 2,062
Over 1,500 Kg:		
Total	2,114	− 319
From Austria	190	− 950
,, Great Britain	100	+ 100
,, Germany	1,502	+ 832
,, Switzerland	226	+ 124
Condensers and accumulators—		
Total	1,080	+ 449
From Great Britain	183	+ 111
,, Germany	760	+ 495
Electrodes for accumulators—		
Total	1,055	+ 462
From Hungary	307	− 4
,, Germany	473	+ 330
Electrodes for furnaces—		
Total*	4,149	+ 2,259
Telegraph and telephone apparatus, including microphones—		
Total	11,828	+ 4,808
From Austria	1,633	+ 696
,, Belgium	692	+ 408
,, Germany	8,215	+ 4,481
,, France	626	+ 596
Signalling and bell apparatus—		
Total*	767	+ 591
Meters and measuring instruments—		
Total	5,831	+ 1,000
From Hungary	580	+ 235
,, Germany	3,479	+ 833
,, Switzerland	1,424	+ 423
Switches and starters for small motors for fans, etc.—		
Total	3,930	+ 1,037
From Austria	298	+ 175
,, Denmark	187	+ 54
,, Germany	2,226	+ 637
,, Sweden	890	+ 24
Cookers, irons, heaters, etc.—		
Total	1,451	+ 348
From Austria	331	+ 224
,, Germany	897	+ 216
Radio-telephone apparatus and parts—		
Total	38,816	+ 5,339
From Austria	8,767	− 1,436
,, Hungary	5,362	+ 1,458
,, Germany	8,172	− 109
,, Holland	10,386	+ 1,349
,, United States	980	+ 44
,, Great Britain	412	− 176
,, Belgium	466	+ 186
Radio-telegraph apparatus and parts—		
Total	2,791	+ 2,651
From Great Britain	2,252	+ 2,241
,, Germany	331	+ 233
High-voltage circuit breakers, switches, starters, resistances and similar apparatus—		
Under 20 Kg:		
Total *	302	+ 201
From 20 to 100 Kg.:		
Total	2,841	+ 755
From Austria	225	+ 79
,, Germany	2,132	+ 406
,, Switzerland	236	+ 222
From 100 to 500 Kg:		
Total	2,750	+ 1,422
From Great Britain	744	+ 687
,, Germany	1,594	+ 968
Over 500 Kg.:		
Total*	1,271	+ 920
Other switchgear, switchboards, etc.—		
Total	23,342	+ 9,054
From Austria	1,796	+ 386
,, Great Britain	767	+ 559
,, Germany	17,450	+ 7,785
,, United States	671	+ 168
Bulbs for torches—		
Total	535	+ 7
From Austria	305	+ 48
,, Germany	226	+ 81
Other incandescent lamp bulbs—		
Total	5,960	− 330
From Austria	436	− 269
,, Hungary	3,830	+ 26
,, Germany	1,307	+ 414
Batteries—		
Total	722	+ 29
From Great Britain	225	+ 18
,, Germany	290	+ 112
,, United States	121	− 119
Underground and submarine cables—		
Total	12,241	+ 7,491
From Austria	1,051	+ 804
,, Italy	507	+ 502
,, Germany	9,675	+ 5,625
Other electrical cable and wire—		
Total	2,326	+ 1,019
From Austria	271	+ 85
,, Great Britain	83	+ 75
,, Germany	1,834	+ 831

* Mainly from Germany.

ELECTRICITY SUPPLY

Burnley's Assisted Wiring Problem. Reconditioned Cooker Charges at Cardiff. Great Yarmouth All-electric Flats. Heston Bulk Supply Question.

Aberdeen.—LIGHTING PLANS.—Great Southern Street is to be illuminated with 250-W mercury vapour lamps, and the housing estates at Tullos and Anderson Drive South are to be lighted by electricity.

Birmingham.—SUB-STATION.—The Electricity Committee is to erect a sub-station on the Kent's Moat estate.

Burnley.—EFFECTS OF HIRE PURCHASE ACT.—In a report submitted to the Town Council it was recommended that in consequence of the provisions of the Hire Purchase Act, 1938, no payments in respect of assisted wiring schemes should be accepted through electricity meters. Councillor Oakes said that of the 23,000 consumers of electricity in the district practically 15,000 had paid for their installations through meters. If that method of payment were stopped it would considerably restrict the activities of the Electricity Department. The Town Clerk said that a number of local authorities were continuing to hire appliances by way of prepayment meters. Under the Act they could be called upon at any time to state the amount which remained unpaid, the date on which instalments became due, &c. This was not possible when the goods were being paid for through the prepayment meter.

A.R.P. at Willesden

Protection against incendiary bombs for the high-voltage switchgear at Willesden has been adopted by Mr. J. D. Spark, borough electrical engineer and manager, without substituting a flat reinforced-concrete roof for the existing one. The shelter shown in the accompanying photograph consists of one thickness of ⅜-in. "Durasteel" sheet together with one thickness of ⅜-in. "Durasteel" impact sheet mounted on an angle-iron framework which is attached to the switchgear. The photograph also shows the provision that has been made for the drainage of oil into trenches filled with granite chips

Cardiff.—DISTRIBUTION PROJECTS.—The Electricity Committee is to extend mains and change over the system of supply in Penarth Road at an estimated cost of £5,696 and has asked the electrical engineer to report as to the probable costs of the remaining change-over work to be carried out in the city.

COOKER HIRING CHARGES.—The electrical engineer has reported regarding the hiring charges for reconditioned cookers and it has been agreed that new hirers should pay the full initial hire charge for completely reconditioned cookers and that where existing consumers who have had cookers on hire for a period of not less than two years change their cookers for completely reconditioned ones, such cookers shall rank as one-year-old models for the purpose of calculating the initial hiring charges payable.

Colchester.—INDUSTRIAL SUPPLIES.—An AC supply is to be given by the Electricity Committee to the Colchester Steel Constructional Co., Ltd., at an estimated cost of £775, subject to the company undertaking to make a minimum annual payment of £250 for a period of three years. The Electricity Committee also proposes to provide a supply costing £240 to the Clacton Sand & Ballast, Ltd., at the gravel pit at St. Osyth.

Derbyshire. — ELECTRICITY FAILURE. — There was a two-hour failure of the electricity supply at Dronfield on Thursday night last week. Meadowhead and Greenhill, parts of Sheffield adjacent to Dronfield, were also without a supply for a time.

Erith.—ELECTRICITY DEMAND AT CHRISTMAS.—During the cold spell before Christmas the distribution system was called upon to carry loads 16 per cent. more than in the previous year, and in the case of particular sub-stations the loads were up to 50 per cent. greater, without anything approaching real trouble being experienced. Mr. E. A. Logan, the borough electrical engineer and manager, informs us that the total kWh supplied on Christmas Day (102,300) represented an increase of 77.2 per cent. over 1937 and 240 per cent. over 1936. In the week before Christmas the coldest weather was on Tuesday, but the daily output continued to rise until Wednesday (181,000 kWh) when there was a maximum load of 10,400 kW in the early evening compared with that of 9,800 kW on Tuesday morning. With the further increase in temperature the demand lessened each day until Christmas, when there was an exceptionally large noon load, reflecting the increased use of electricity for cooking.

Fakenham (Norfolk).—NEW RURAL SUPPLIES IN 1939.—A schedule received by the Council from the Electricity Commissioners states that the following villages will have a supply of electricity before the end of 1939: Flitcham, parts of Leziate, East Winch, Congham, Pentney, and probably Blackborough End.

Felixstowe.—SUB-STATION.—The Electricity Department is to erect a sub-station on the Cemetery Site, Langley Avenue.

Folkestone.—ADDITIONAL STREET LIGHTING.—The Town Council has approved the installation of additional street lighting in various roads in the town.

Fort William.—PLANT OVERLOADED.—At a recent meeting of the Town Council Mr. Fraser, the burgh electrical engineer, reported that he had received about twenty applications for a supply during the winter season, but it had been found impossible to provide these supplies as even at present the plant was very much overloaded.

Godstone.—OVERHEAD LINE.—No objection has been raised by the Rural District Council to the proposal of the Sevenoaks & District Electricity Co., Ltd., to erect an overhead line at Fiddlers Grove, Bletchingley.

Great Yarmouth.—ELECTRICITY FROM REFUSE SCHEME.—At a meeting of the Town Council a report was submitted by the borough electrical engineer on his investigation into the possibilities of the production of steam by refuse destruction for generating electricity and this was referred to a joint meeting of the Electricity, Health and Highways Committees.

ALL-ELECTRIC DWELLINGS.—Whether or not electricity should be used for all purposes in the 198 flats and maisonettes to be erected by the Town Council on the Nos. 1 and 2 Clearance Areas was a subject under discussion at a Council meeting

Fylde Coast Supply Failure

AN interruption of the 33-kV bulk supplies furnished from the Ribble power station, Preston, to the Fylde Coast towns, Blackpool, Lytham St. Annes and Fleetwood, occurred at about 4.45 p.m. on January 6th. In a joint statement Messrs. G. A. Robertson and H. F. Shanahan, the borough electrical engineers of Preston and Blackpool, explain that normally four feeders (partly overhead and partly underground) transmit supplies; two run direct to the Blackpool sub-station and the other two are looped into the switch-house at Peel *en route*, from which branch feeders are taken to Lytham St. Annes and Fleetwood.

One of the cables between Ribble power station and Peel switch-house was out of commission when the second failed. This of itself would not have led to an interruption of supply to Lytham St. Annes and Fleetwood, since there was an alternative source of supply to Peel switch-house through the remaining two cables from Preston to the Blackpool sub-station and thence back to Peel.

A slight fire broke out, however, in the 33-kV switchroom of the Blackpool sub-station and simultaneously a complete shutdown took place on the supplies to all three towns. The fire appears to have been due to a bus-bar fault in the metal-clad switchgear, and one of the switches and two of the incoming cables were damaged. The fire was extinguished by the Blackpool fire brigade before it reached serious proportions. Investigation of the breakdown and subsequent events is being made.

By means of temporary connections supplies were restored to Lytham St. Annes and Fleetwood about 1 a.m. on January 7th, *i.e.*, after 8¼ hours. About half of Blackpool's normal load was supplied from the local generating station, and through Friday night and Saturday both staffs, in conjunction with representatives of the switchgear and cable manufacturers, worked continuously in rearranging the switchgear and cables, so that a bulk supply was restored to Blackpool by 5.50 a.m. on January 8th.

last week. The Housing Committee had accepted an offer by the Yarmouth Gas Co. to install a two-point hot-plate at its own expense in each of the houses on condition that the Corporation provided gas coppers which, under the scheme, the company would install free. The General Purposes Committee, however, carried an amendment that electricity should be used for all purposes and this was passed by the Council by seventeen votes to sixteen. A further amendment that the matter should be referred back to the General Purposes Committee with power to act was lost by twenty votes to seventeen.

Hazel Grove and Bramhall.—STREET LIGHTING.—The Urban District Council proposes to have streets at Woodford lighted by electricity.

Heston and Isleworth.—BULK SUPPLY CHARGES.—After considering comparative estimates prepared by the borough electrical engineer, the Electricity Committee some time ago came to the conclusion that, *prima facie*, the generation by the Council of the whole of its requirements would result in a cheaper supply than would be achieved by taking a partial or full bulk supply from the Metropolitan Electric Supply Co. In order that the position should be fully investigated, Messrs. May & Hawes, consulting engineers, were appointed to examine the matter in detail. Conferences took place between the Electricity Commissioners, representatives of the company and the consulting engineers with regard to the bulk supply charges, but complete agreement was not reached. The Electricity Committee, in reporting to the Council at its recent meeting, stated that the exact meaning of Section 12 of the Electricity (Supply) Act, 1926, and the method of determining charges under it were matters of considerable controversy, and the consultants stated that to the best of their knowledge no rules had ever been laid down for determining the charges to be made under it. The Council agreed to ask the Commissioners to fix the price to be paid for a bulk supply, a procedure which it was anticipated would involve the holding of an inquiry.

Keighley.—COOKERS ON HIRE.—For an experimental period of three months breakfast cookers are to be let out on simple hire at a rent proportionate to that charged for the larger cookers.

London.—HAMPSTEAD.—As from the beginning of the year a reduced flat rate of 1½d. per kWh is being charged for the lighting of shop windows after 7.30 p.m.

Newcastle-on-Tyne.—WIRING HOUSES.—The City Council has referred back a £42,127 scheme for wiring 4,891 houses which at present have gas lighting and purchasing the hired wiring in 1,068 houses. The Lord Mayor, introducing the scheme, said that after protracted negotiations with the supply companies the estimate had been reduced by £8,000 to the present rock-bottom figure. The amendment for the reference back of the recommendation was based on the contention that there should be an increase in rentals to meet the cost.

Torquay.—COOKERS PROVIDED FREE.—A scheme has been adopted for the installation of cookers and the use of them free of hire charges for a period of one quarter, provided that if the consumer decides to retain the cooker he will pay for the wiring of the circuit and the usual hire charges after the first quarter.

SUB-STATION.—In order to cope with the growth of the load in the Chelston area the Electricity Committee is to construct a major sub-station in that area.

DEVELOPMENTS PROVE SUCCESSFUL.—The cables and other apparatus provided for under the 33-kV transmission scheme have now been installed and are in commission over an area extending from the power station, Newton Abbot, to Totnes. The two oil-filled cables from Newton Abbot to Torquay have proved very efficient in dealing with the highest peak load ever recorded in the borough during the recent spell of cold weather and both cables were then operated simultaneously at 33 kVA.

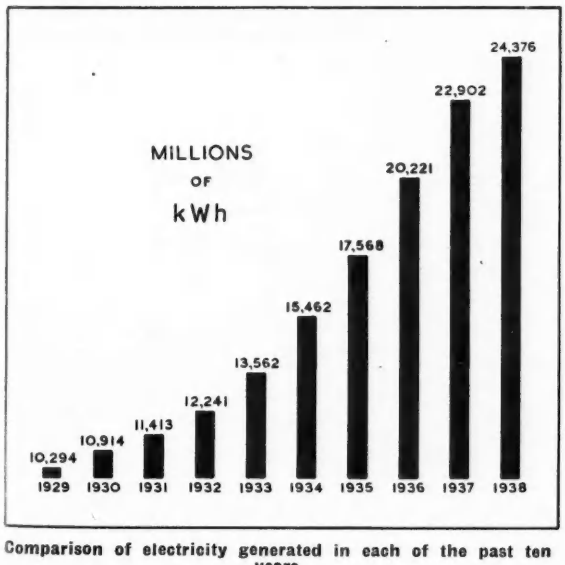
Wells (Norfolk).—STREET LIGHTING.—An estimate for street lighting has been submitted by the East Anglian Electric Supply Co. and the Gas Committee is preparing an estimate of the total cost of the reorganisation of the present gas system on the basis of a new type of lamp recently introduced, and this will be compared with the company's quotations.

Wolverhampton.—NEW EQUIPMENT.—The Electricity Department is to provide switchgear at the Cosford works at a cost of £1,500 and extend mains to Saredon and Little Saredon at a cost of £1,119. The extra-high-voltage system between the Dixon Street and Parkfield Road sub-stations is to be strengthened at a cost of £360.

SUB-STATIONS.—The Electricity Committee is to erect new sub-stations at Albrighton (£1,437) and Cooper Street (£1,509).

More Electricity Generated

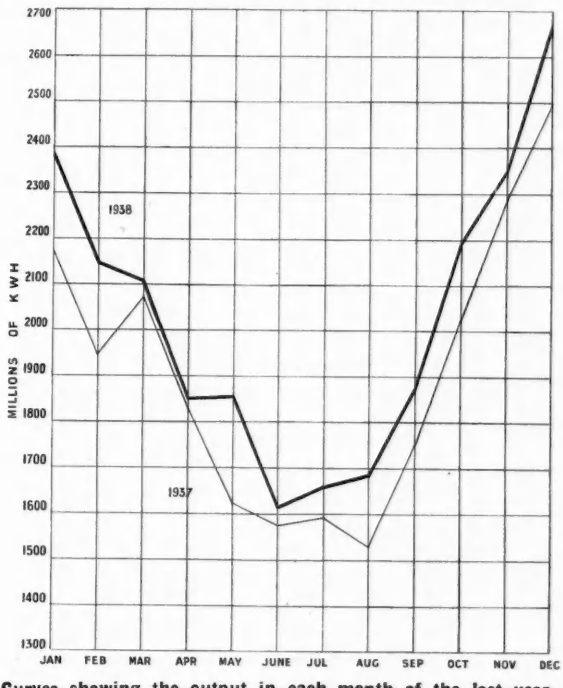
OFFICIAL returns rendered to the Electricity Commissioners show that 2,675 million kWh was generated by authorised undertakings in Great Britain during December as compared with the revised figure of 2,497 million kWh in the corresponding month of 1937, representing an increase of 178 million kWh, or 7.1 per cent. The number of working days in the month (*i.e.*, excluding Sundays and Bank Holidays) was twenty-five, the same as in December, 1937. The 2,675 million kWh generated last month easily constituted a record, and in this the recent cold spell must have helped considerably. The comparatively moderate increase of 7.1 per cent. is explained by the fact that the December, 1937, output



Comparison of electricity generated in each of the past ten years

was particularly large, exceeding that for the corresponding month of the previous year by 14.7 per cent., compared with an average increase for the year of 13.3 per cent.

During 1938 the total quantity of electricity generated by authorised undertakings was 24,376 million kWh, as compared with the revised figure of 22,902 million kWh in 1937, representing an increase of 1,474 million kWh, or 6.4 per cent. The progress was at a lower rate than in recent years, due to



Curves showing the output in each month of the last year and 1937

the falling off in industrial activity and the mild weather that prevailed in the spring. The accompanying curves show, however, that in no month did the total quantity of electricity generated fall below the 1937 amount. In the United States, on the other hand, the output remained consistently lower than in 1937 until November. The pillar graph provides a comparison of the growth in output during the past ten years. The base-line of the diagram is 10,000 million kWh.

COMMUNICATIONS

Australia.—DIRECT LINK WITH AMERICA.—A *Reuter* report from Sydney states that a direct radio-telephone service is now in operation between Australia and the United States. Formerly calls went by way of London. The direct service has resulted in a big reduction in call charges, ranging from 30 to 50 per cent. At the inauguration of the new service the Australian Minister for External Affairs (Mr. W. M. Hughes) spoke to the Assistant Secretary of State in Washington (Mr. F. B. Sayre).

Great Britain.—LONG-DISTANCE TELEVISION RECEPTION.—Recent reports of the reception in America of television from Alexandra Palace have impelled Dr. Clarence Tierney, chairman of the council of the Television Society, to recall that this is not the first time that British television has been received on the other side of the Atlantic. Early in 1928—eleven years ago—a demonstration of the Baird system was arranged by the Baird Company with the co-operation of an amateur in Hartsdale, a suburb of New York. Over a lengthy period various images were transmitted from London *via* the company's 45-metre private station and were successfully received on a ground glass screen measuring two by three inches. Although marred at times by atmospherics, the reception was reported to be very good and it was considered that better results could have been obtained if a higher-power transmitter had been used.

RADIO RELAYS.—A further decrease in the number of subscribers to radio relay exchanges is revealed by statistics that have just become available. At September 30th, 1938, there were 249,842 subscribers to 326 relay exchanges, compared with 251,164 subscribers to 327 exchanges at June 30th, 1938, the percentage of subscribers' licences to the total receiving licences issued being 2.85 and 2.91 respectively.

RADIO INTERFERENCE.—For a number of years radio reception has suffered from electrical interference, the degree of which has increased with the greater use of short waves. Partly as the result of the expenditure of a large amount of money on research, and partly through work carried out privately all the necessary information has been obtained, and it now remains to bring into force those means which will avoid or suppress radio interference. In a statement on the subject, Major L. H. Peter, chairman of the R.M.A., says that the most serious forms of interference are caused by motor car ignition systems and electro-medical apparatus, and of these the first is so widespread as to predominate over all others. Ethically there is no reason why the ether should not be confined to its proper use, but it is necessary to consider what hardships will be imposed in clearing up the situation. It costs from 3s. to 4s. to suppress the interference created by the average motor car to a level which will not interfere with television transmissions and short-wave broadcasts provided this is done during the course of manufacture of the motor car. In a few cases of large and expensive cars the cost may be somewhat higher, but is still small in relation to the cost of many non-essential accessories normally provided. While legislation in this matter will undoubtedly follow it is necessarily slow, and if motor car manufacturers and the makers of electrical appliances capable of producing interference really appreciate the situation they should act in advance of such legislation. The position of supply authorities will also require consideration as their large networks may act either as electrical conductors of interference or as radiating networks. In addition, the superimposition on supply networks of impulse devices increases the risk of interference with radio and television receivers. Supply companies are authorised to distribute power at certain declared voltages and frequencies, and any tendency of their networks to become carriers or radiators of frequencies harmful to radio reception should be challenged. There are a number of industrial sources of interference, each of which must be dealt with individually, but if the principle that interference is not permissible is properly established, as it should be, there will be very little difficulty in dealing with these individual cases.

Portugal.—AUTOMATIC TELEPHONY.—The Government has placed a contract with the Automatic Telephone and Electric Co., Ltd., for automatic telephone equipment of the "Strowger" type valued at £650,000, spread over fifteen years.

TRACTION

Birmingham.—TWO TRAM ROUTES TO BE ABANDONED.—The Transport Committee has recommended the discontinuance of the Stechford and Dudley Road tram services. It is proposed that motor-buses shall take their place.

Glasgow.—TRAMWAY DEVELOPMENTS.—The Transport Committee is to construct a new siding in Boydstone Road, Carnwadric, at an estimated cost of £2,500 and in Stobcross Street at Anderston Cross, at an estimated cost of £3,900.

Hull.—TROLLEY-BUSES.—The Holderness Road depôt is to be converted for trolley-buses at an estimated cost of £500.

Leeds.—TUBE RAILWAY PROPOSAL.—On Monday the Leeds Traffic Advisory Committee referred to a sub-committee a proposal that an underground railway, which would provide shelter from air raids, should be constructed. The proposed railway would be 12¼ miles long, and would cost £6,250,000.

Northern Ireland.—BELFAST TROLLEY-BUS DECISION.—The Belfast City Council has approved the recommendation of the Transport Committee in favour of trolley-buses taking the place of the trams.

Nottingham.—COST OF ELECTRICITY FOR TRACTION.—The price that the Transport Committee was charged for electricity was referred to by Alderman R. E. Ashworth at last week's meeting of the City Council. He said that unless the Electricity Department was prepared to charge the transport undertaking the same price as it did large private users he feared that they would shortly see the abolition of trolley-buses in the city. Coun. C. W. Plackett, chairman of the Transport Committee, said that the Committee was now paying 0.76d. per kWh. The question of electricity charges had been considered on many occasions and probably in the near future he would go to the Electricity Committee for a further reduction.

Southend-on-Sea.—TROLLEY-BUSES.—The Corporation is recommended to erect overhead equipment for trolley-buses from the Kursaal to Thorpe Bay Corner, at an estimated cost of £3,000.

Fewer Tramcars and More Trolley-buses

Ministry of Transport's annual statistical survey

THERE was a reduction of ten in the number of tramway undertakings operated at the end of March, 1938, by fifty-eight municipalities and at the end of 1937 by eight companies. In the annual Return of the Ministry of Transport relating to Tramways and Light Railways and Trolley Vehicle Undertakings (Stationery Office, 2s. net) it is shown that this meant a decline in route miles of about 106, the electrified mileage becoming 999. These figures are exclusive of the London Passenger Transport Board system (particularised in the Board's own reports) which worked 175 route miles in the year ended June 30th, 1938, compared with 226 in 1937.

Passenger journeys, 2,357 million, were less by 4.75 per cent. and car-miles run, 201 million, by 5.63 per cent. Car-miles run per car-hour were 8.83 (8.75 in 1936-37). In addition 701 million passenger journeys (a falling off of 22.5 per cent.) were run by the L.P.T.B. Apart from the latter, 508 million kWh was used, giving an average of 2.53 kWh per car-mile, as compared with 516 million kWh and 2.42 kWh per car-mile in the previous year.

Capital expenditure on municipal tramways amounted to £45.7 million and on company systems £4.99 million. Gross receipts in the former case were £12.2 million and working expenses £9.9 million, giving an operating ratio of 81.2 per cent.; for the companies the corresponding figures were £715,000 and £553,000, the operating ratio being 77.4 per cent.

Local authority undertakings received £10,700 from local rates and contributed £157,000 in rate relief. All such undertakings earned income in 1937-38.

During the period under review thirty-eight trolley-bus undertakings (five company owned) were in operation and twenty more had powers not as yet exercised. Included in the former were five undertakings which started working in the twelve months, *viz.*, Audenshaw U.D.C., Cleethorpes, Hull and Manchester Corporations and Stalybridge, &c., Transport and Electricity Board. Apart from the L.P.T.B. the number of route miles open for traffic increased by 29 to 445 (93 company), while the number of passenger journeys advanced by 68 million to 497 million (64 million company). Vehicle-miles run rose by nearly 5 million to 47 million, being equivalent to 9.5 per vehicle hour. The amount of electrical energy consumed was 106 million kWh, nearly 13 million in excess of the previous year's figure, the average per vehicle-mile being 2.26 as against 2.21 kWh. Local authorities took 93 million kWh, or 2.31 per vehicle-mile and companies 13 million kWh, or 1.93 per car-mile. In addition, the L.P.T.B. operated trolley vehicles carrying 368 million passengers over 198 route miles during the year ended June 30th, 1938, compared with 203 million passengers and 122 miles in the preceding year.

The capital expenditure incurred was £6,290,000. Of this £5,026,000 was provided by local authorities, which secured gross receipts of £2,538,000, with working expenses of £1,899,000, giving an operating ratio of 74.8 per cent. The gross receipts of the companies, which put up £1,264,000 of the capital, worked out at £345,000, with working expenses of £243,000, showing an operating ratio of 70.3 per cent. Local authority concerns paid £81,000 in interest and dividends and £238,000 in debt redemption. The companies' disbursements under the first head came to £26,000.

FINANCIAL SECTION

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

British Rola, Ltd.—Public company. Registered December 31st. Nominal capital, £150,000. Objects: To acquire the business of the British Rola Co., Ltd. (incorporated in 1931), and to carry on the business of manufacturers of and dealers in wireless, television and telephone parts, electric motors and batteries, cables, signs, condensers, valves, bulbs, lamps and all kinds of radio, televisor, electrical and engineering devices, instruments and apparatus, &c. The purchase consideration is £110,000, payable in shares, plus the covenant to discharge the liabilities (except surtax) of the old company, amounting to £12,509. The first directors are: J. C. Moth, 19, Berkeley Street, W.1 (director of Hyde Simplex, Ltd.), R. W. Cotton, 76, Regency Lodge, Adelaide Road, N.W.3, W. T. Maynard, 25, Prout Grove, Neasden, N.W.10, A. L. Smith, "Greenhayes," Claygate Lane, Esher, and B A. Engholm, 2530 Superior, Cleveland, Ohio, U.S.A. Registered office: Minerva Road, Park Royal, N.W.10.

Petters, Ltd.—Private company. Registered January 2nd. Nominal capital, £25,000. Objects: To acquire the business of manufacturing, selling and servicing compression ignition and combustion engines and accessories carried on at Yeovil by the company lately known as Petters, Ltd., but to be known as Associated British Engineering, Ltd., and the benefit of foreign agencies and sales organisations in connection with the said business, and to carry on the business of engineers, electricians, boiler makers, oil engine manufacturers, letters on hire or hire-purchase of engines, boilers and machinery, &c. The first directors are: A. P. Good, T. B. Keep, R. C. Petter, R. J. Norton and J. Day. Solicitors: Sydney Morse & Co., Alder House, Aldersgate Street, E.C.

Hotric, Ltd.—Private company. Registered January 5th. Capital, £10,000. Objects: To adopt an agreement with H. Webb & Co. (Engineers), Ltd., for the acquisition of certain property, including the trade mark "Hotric"; and to carry on the business of general, electrical and mechanical engineers, &c. The subscribers (each with one share) are: L. A. Waller, 27, Bentinck Close, Prince Albert Road, N.W.8, engineer; and H. Sturton, 74, Great Tower Street, E.C.3, solicitor. L. A. Waller is to be one of the first directors. Registered office: West Road, Tottenham, N.17.

Sandilands (Electric), Ltd.—Private company. Registered January 6th. Capital, £3,000. Objects: To acquire the business now carried on at 151, Stroud Green Road, Finsbury Park, N.4, including stock-in-trade and other assets of the business of electrical contractors, &c. A. E. Sandilands, 53, Ferme Park Road, Stroud Green, N.4, is the first and permanent director. Registered office: 151, Stroud Green Road, N.4.

F. Hill (Electrical Installations), Ltd.—Private company. Registered January 6th. Capital, £2,000. Objects: To acquire the business of the Electric Power Installation Co., hitherto carried on by F. Hill, and to carry on the business of electrical engineers and contractors, &c. The directors are: F. Hill (permanent governing director and chairman), and Mrs. L. Hill, both of 46, Craignish Avenue, Norbury, S.W. Registered office: Dominion Buildings, 2, South Place, E.C.2.

Kelvin-Norton Electric Co., Ltd.—Private company. Registered January 3rd. Capital, £1,000. Objects: To carry on the business of electrical, mechanical or general engineers, electricians, manufacturers of and dealers in electrical apparatus, &c. G. A. Edwards, The Cottage, Deans Green, Lymm, Ches, is permanent governing director. Secretary: E. R. Peake. Registered office: Naylor Street, Warrington.

Westons (Epsom), Ltd.—Private company. Registered December 30th. Capital, £10,000. Objects: To carry on the business (both wholesale and retail) of manufacturers of and dealers in wireless apparatus and accessories, &c. The directors are: R. E. Fiedler, 83, Manor Green Road, Epsom, Surrey, and R. G. Dettmar, 21, Craddocks Avenue, Ashtead, Surrey. Secretary: E. Kuhn.

H. A. Neale & Co., Ltd.—Private company. Registered January 2nd. Capital, £2,000. Objects: To carry on the business of mechanical, electrical, heating and ventilating engineers, &c. The directors are: H. A. Neale, 18, Effingham Road, Surbiton, Surrey, and E. G. Evans, C.A., 3, London Wall Buildings, E.C.2. Solicitors: Mason & Co., 115, High Holborn, W.C.1.

Bywater Products, Ltd.—Private company. Registered January 2nd. Capital, £1,000. Objects: To carry on the business of mechanical and electrical engineers and agents and dealers in machinery, apparatus, tools and equipment of every kind, both in this country and abroad. The directors are: U. J. Bywater, 20, Palace Road, East Molesey, Surrey, and J. C. McCollin, 106, Kingsland Road, E.2. Registered office: 68, Victoria Street, S.W.1.

D. Timmins & Sons (Bristol), Ltd.—Private company. Registered January 3rd. Capital, £2,500. Objects: To acquire the business of an engineer now carried on at Brook Road, Fishponds, Bristol, as D. Timmins & Sons, and to carry on the business of electrical and mechanical engineers, manufacturers of implements and machinery of all kinds, &c. The permanent directors are: D. Timmins (chairman), 12, Brook Road, Fishponds, Bristol, and two others. Registered office: Brook Road, Fishponds, Bristol.

Light Projectors, Ltd.—Private company. Registered January 4th. Capital, £1,000. Objects: To adopt agreements (1) with Lights International and (2) with Arthur Lyon, and to carry on the business of manufacturers of and dealers in lighting systems and articles in connection therewith under the designs, processes and letters patent to be acquired from Lights International, electrical engineers, &c. The permanent directors are: A. Lyon, Little Arden, Mount Park Road, Harrow, and two others. Registered office: Africa House, Kingsway, W.C.2.

Electric Homes (Provincial), Ltd.—Private company. Registered January 4th. Capital, £2,000. Objects: To carry on the business of dealers in and manufacturers and repairers of electrical appliances, plant, machinery and supplies of all kinds, dynamos, motors, armatures, magnetos, batteries, &c. The directors are: A. E. F. Luck, 129, Addington Road, West Wickham, and three others. Registered office: Whitgift Chambers, 34-6, High Street, Croydon.

Returns of Electrical Companies

Statements of Capital

H. Featherstone, Ltd.—Capital, £3,000 in £1 shares. Return dated May 27th (filed September 28th), 1938. All shares taken up. £3,000 paid. Mortgages and charges, nil.

Ernest Jones (Bradford), Ltd.—Capital, £3,000 in £1 shares. Return dated August 17th (filed November 28th), 1938. 1,473 shares taken up. £1,473 paid. Mortgages and charges, nil.

Neon Luminous Tubes (Lund Signs), Ltd.—Capital, £2,000 in 1,000 preference and 1,000 ordinary shares of £1. Return dated October 24th, 1938. 692 preference and 1,000 ordinary shares taken up. £692 paid, £1,000 considered as paid. Mortgages and charges nil.

Mersey Cable Works, Ltd.—Capital, £70,000 in £1 shares. Return dated October 24th, 1938. All shares taken up. £62,400 paid, £7,600 considered as paid. Mortgages and charges nil.

Bushing Co., Ltd.—Capital, £60,000 in £1 shares. Return dated October 28th, 1938. All shares taken up. £60,000 paid. Mortgages and charges nil.

Donovan Electrical Co., Ltd.—Capital, £50,000 in £1 shares. Return dated October 31st, 1938. 29,100 shares taken up. £29,100 considered as paid. Mortgages and charges nil.

Dynamic Electrical Co., Ltd.—Capital, £100,000 in 2,000,000 shares of 1s. each. Return dated October 31st, 1938. 1,500,000 shares taken up. £75,000 paid. Mortgages and charges nil.

Perak River Hydro-Electric Power Co., Ltd.—Capital, £3,500,000 in 1,250,000 5 per cent. cumulative preference, 1,750,000 ordinary and 500,000 "A" shares of £1 each. Return dated November 2nd, 1938. 1,250,000 preference and 1,750,000 ordinary shares taken up. £808,041 paid on 400,000 preference and 408,041 ordinary shares, £2,191,959 considered as paid on 850,000 preference and 1,341,959 ordinary shares. Mortgages and charges: £915,900.

Taylor, Whiting and Taylor, Ltd.—Capital, £4,000 in £1 shares. Return dated October 21st, 1938. 3,962 shares taken up. £2 paid. £3,960 considered as paid. Mortgages and charges, nil.

Increases of Capital

Crompton Parkinson, Ltd.—The nominal capital has been increased by the addition of £300,000, beyond the registered capital of £1,700,000. The additional capital is divided into 1,200,000 "A" ordinary shares of 5s.

Multitone Electric Co., Ltd.—The nominal capital has been increased by the addition of £4,000 in £1 ordinary shares, beyond the registered capital of £16,000 .

Culm Valley Electric Supply Co., Ltd.—The nominal capital has been increased by the addition of £10,000 in £1 ordinary shares, beyond the registered capital of £70,000.

Brush Electrical Engineering Co., Ltd.—The nominal capital has been increased by the addition of £400,000, beyond the registered capital of £600,000. The additional capital is divided into 200,000 5½ per cent. cumulative preference, 90,000 ordinary and 110,000 unclassified shares of £1.

Mortgages and Charges

London Power Co., Ltd.—Particulars have been filed on £1,000,000 3½ per cent. redeemable debenture stock (1952/72), authorised by resolution of November 18th, and covered by trust deed dated December 9th, 1938, charged on the company's undertaking, property and revenue, present and future. The whole amount is now issued. Trustees: Law Debenture Corporation, Ltd. The above is part of the principal amount of stock authorised by a Trust deed dated February 11th, 1938.

Lowe & Oliver, Ltd.—Satisfaction to the extent of £1,100 on November 27th, 1938, of debentures authorised November 25th, 1933, and registered December 1st, 1933, securing £2,000.

J. & N. Wade (Portsmouth), Ltd. (formerly J. & N. Wade, Ltd.).—Mortgage on 1 and 3, Clyde Street, Gosport, dated December 5th, 1938, to secure £734 and further advances. Holders: City of Portsmouth Building Society.

Lawson Beck, Ltd.—Debenture charged on site No. K46 (A) on the Team Valley Estate at Gateshead, with factory, &c., thereon, and the company's undertaking and other property, present and future, including uncalled capital, dated December 17th, 1938, to secure £200. Holders: Special Areas Reconstruction Association, Ltd.

Receiver Appointed

Day's Radio, Ltd.—Two notices of the appointment of G. C. Jarvis, of 115/117, Cannon Street, E.C.4, as receiver and manager on (1) December 28th, 1938, under powers contained in debenture dated December 14th, 1938, and (2) on December 29th, 1938, under powers contained in debentures dated October 4th, 1938.

Reports and Dividends

Turner & Newall, Ltd., report a trading profit of £1,650,386 for the year ended September 30th, as compared with £1,543,876 for the preceding year. After providing £130,693 (£122,117) for depreciation, £154,749 (£85,164) for income tax, and £84,000 (£40,000) for N.D.C., the net profit is £1,277,694 (£1,293,489). The dividend on the ordinary shares is maintained at 20 per cent., £100,000 is placed to general reserve and £10,000 to the welfare trust, leaving £116,610 to be carried forward, against £115,770. Accompanying the report is a copy of the chairman's speech to be delivered at the meeting on January 26th. This states that considerable sums have been provided in the form of additional share capital to finance the building of two additional asbestos cement factories for the Indian subsidiary, Asbestos Cement, Ltd., at Calcutta and Bombay. Capital has also been provided in connection with the opening of the Havelock asbestos mine in Swaziland, under the direction of New Amianthus Mines, Ltd. The report adds that there has been a distinct falling-off in sales in recent months, but if the international position improves and the economic condition of this country is satisfactory there is no reason why the company should not continue to be as successful as in the last few years.

The Westinghouse Brake & Signal Co., Ltd., announces a net profit of £262,518 for the year ended September 30th last, as compared with £275,632 in 1936-37. The latter figure, however, included a transfer of £15,856 from reserve for losses of subsidiaries. A dividend of 10 per cent. and a cash bonus of 7½ per cent. are again to be paid. The general reserve is increased to £400,000 by the allocation of £75,000 (same) and the staff pensions account again receives £10,000, bringing it up to £75,000. The carry-forward is increased from £70,569 to £105,106.

R. B. Pullin & Co., Ltd., record a profit of £42,300 for the year ended October 31st, against £29,421 for the preceding year. From this £13,962 (against £8,333) has been required for taxes. A final dividend of 20 per cent. is to be paid, making 25 per cent. for the year. For the previous period from February 25th, 1937, when the company was incorporated, to October 31st, 1937, a single payment of 15 per cent. was made equal to 22.1 per cent. per annum. A sum of £5,966 (£5,068) is carried forward. In view of an anticipated increase in production and in the range of the company's products, together with the possibility of the erection of a new factory the directors propose to increase the nominal capital by £30,000 to £100,000. Meeting, January 19th.

J. & E. Hall, Ltd., report net profits amounting to £69,280 for the year ended September 30th, against £44,888 for the preceding year. From the profit for 1937-38 a sum of £12,000 has to be deducted for income tax, which is treated as an appropriation, but the 1936-37 figure was arrived at after charging £2,500 for income tax. It is proposed to increase the ordinary dividend from 7 to 10 per cent.

Newman Industries, Ltd., is to pay the dividend on the 6 per cent. cumulative participating preferred ordinary shares, plus an additional 2 per cent., making in all 5 per cent. actual for the half-year ended December 31st. A dividend equivalent to 2.4d. per share is to be paid on the 6 per cent. redeemable cumulative preference awards in respect of the period November 30th, 1938, to January 31st.

The Southern Railway Co. on Wednesday offered for sale at £98 10s. per cent. £7,500,000 of 4 per cent. debenture stock redeemable 1970-1980. The issue is required to cover expenditure of a capital nature in connection with the company's programme of electrification and other works.

Edmundsons Electricity Corporation, Ltd., reports that the results of the operations of its group of companies during December, as compared with the corresponding month of 1937, show an increase of 14 per cent. in kWh sold.

Stocks and Shares

TUESDAY EVENING.

THE position of British Government and other gilt-edged stocks has been improved by the transfer of a nominal £200 million (equivalent to £350 million in gold) to the Exchange Equalisation Fund. This had the immediate effect of steadying the purely investment issues, the assumption being, of course, that such a step would save a further decline in sterling as against the value of the dollar. It cannot be said to have induced any noticeable increase in the volume of Stock Exchange business, save in those markets where gilt-edged stocks are domiciled.

The general disposition of industrial markets continues to be firm. American politics dominate the position in the United States, and the visit of our own Prime Minister to Italy, welcome as the proposal was when first made, seems to have lost a good deal of the significance that it possessed when originally announced. The more hopeful sentiment in regard to the outlook for trade conditions is reflected in good recoveries in Cable and Wireless stocks.

Government Expenditure

From Government announcements, as well as from reports by companies in the industry, it is evident that many electrical equipment and engineering companies have order books comfortably lined with Government orders in connection with national defence. This aspect has helped electrical equipment shares to maintain their good reputation in the investor's estimation, and largely explains the recent rise in the popularity of shares in many of the smaller engineering companies. A number of these were floated a year or two back and received somewhat scant attention at the time. Now that companies can point to work in hand sufficient to keep them occupied for perhaps two years ahead, there is an attraction, difficult to resist, in yields—up to 10 per cent. in some cases—which shares in various of the undertakings afford.

Railway Developments

In addition to the A.R.P. plan, further grist is promised to the electrical manufacturers' mill by way of the new £7½ millions of debenture stock issued this week by the Southern Railway.

Apparently ineffectual against the present wait-and-see mood of investment, news of this kind acts nevertheless as a discouragement to the selling of electrical shares, and is reassuring, in a more positive way, from the dividend point of view.

After a spell of hesitation, the Home Railway market picked up confidence on a reassuring dividend decision by the L.N.E.R. Debentures comparable with the new Southern issue, however, came down by two or three points when the terms of the latter were published.

Gilt-edged Improvement

Although the huge gold transaction between the Bank and the Exchange Equalisation Fund has not so far been entirely successful in removing anxiety over the position of sterling, it seems nevertheless to have put a stop to the drifting tendency of prices in the gilt-edged market. Before the decision, the price of War Loan, for instance, after falling during 1938 from 101½ to 98⅛, had sagged further to 97¼. The price is now up to 98. It is to be remembered that the market has generally to contend, at this time of year, with selling to meet the income tax demands; moreover, the turn for the better in French domestic affairs is reported to have set up a flow of money across the Channel. The successful defence of sterling, however, would remove from the gilt-edged market a source of weakness which has been making its presence felt for some considerable time.

Electrical Equipment for A.R.P.

The Government's scheme for spending £3,000,000 on a national reserve of electrical equipment makes good news for the market most concerned, but has so far gone without any impression on share prices. It seems that the size of the figure is not impressive enough to break through the industrial market's preoccupation with the conditions which have made such a precaution advisable. The electricity supply industry is to split with the Government the cost of this plan for purchasing equipment to replace switchgear, &c., in the event of air-raid damage to electrical plant. The intimation that the Central Electricity Board is responsible for collecting half the money through a levy on electricity supply undertakings caused only the briefest of qualms in the share market. Spread over so many authorities, the amount involved is regarded as being of little significance to the individual concerns or to the safety of their stockholders' dividends.

Crompton Parkinson

Crompton Parkinsons stand at 15s. 3d. after deduction of the bonus rights from the price. Because of the scrip bonus, this year's dividends will be paid on ordinary capital increased by 50 per cent. Cash distributions for 1938 totalled 30 per cent. of which half took the form of a special cash bonus. The full rate represents 20 per cent. on the present capital, and makes the yield over 6½ per cent. The future dividend policy, it was said in the course of the chairman's speech, is to be changed to fit in with the more staid pace at which profits are likely in future to expand. The idea is to pay a steady 15 per cent., supplemented by such cash bonuses as the trading results and cash requirements permit. It is a matter of comment that, on the last declared distributions, the yield on Cromptons is appreciably higher than on others of the leading electrical equipment shares. The price may have been subdued, it is thought, by selling on the part of those holders who preferred to cash their bonus rights rather than retain the new shares.

Miscellaneous Matters.

Business is quieter on Wall Street while the President's message to Congress and the Budget statement are being digested. The former was construed favourably in so far as it contained implications of amicable co-operation between the Administration and the business community. Later on, the market seemed rather perturbed by the Budget figures. These provide for a deficit which certainly looks formidable to orthodox minds. Utilities are again one of the stronger sections of a generally hesitant market, with American Tel. and Tel. at the highest price for more than a year.

Cable and Wireless stocks are among the few issues to have gained ground during the week, the improvement being due, it appears, to the feeling that the prospect is not so black as the recent low prices would paint it. The ordinary, at 39½, is as much as 4 points to the good, while the preference, at 80, has gained nearly as much ground.

London Transport "C" stock responded scarcely at all to news of the further progress towards an increase of fares. Elsewhere in the traction group Bristol Trams have put on half a crown, to 43s. 9d.; and of the overseas companies, Anglo-Argentine Tramway issues are a better market on news of improved local conditions.

Steel and engineering shares lost some of their year-end buoyancy. Vickers, at 22s. 9d., and Tube Investments, at 85s. 9d., showing reactionary tendencies. Westinghouse Brakes eased off to 53s. on the eve of the dividend, which proved to be the same as last year's 17½ per cent.

ELECTRICAL COMPANIES' SHARES

Prices, dividends and yields

Company.	1938. High-est.	1938. Low-est.	Dividend. Pre-vious.	Dividend. Last.	Price Jan. 10.	Rise or Fall.	Yield p.c. £ s. d.
Home Electricity Companies							
Bournemouth and Poole ...	68/3	62/–	15	15	67/6	—	4 9 0
British Power & Light ...	30/9	24/6	6	7	27/6	—	4 18 3
City of London	34/6	28/6	7½	7½	32/–	—	4 13 9
Clyde Valley	42/6	33/–	8	8	36/3	—	4 8 2
County of London... ...	51/9	38/9	10½	10½	44/6	—	4 14 5
Edmundson's:							
7% Pref....	33/3	30/–	7	7	31/3	—	4 9 6
Ord.	40/9	18/9	9	9	25/6	—	—
Elec. Dis. Yorkshire ...	43/6	37/9	9	9	41/3	—	4 7 5
Elec. Fin. and Securities...	51/9	49/–	12½	12½	47/6	—	5 5 3
Elec. Supply Corporation...	55/–	50/–	12	12	51/3	—	4 13 5
Isle of Thanet	21/3	18/6	4	4	20/–	—	4 0 0
Lancs Light and Power ...	35/–	26/–	7½	7½	30/9	—	4 17 7
Llanelly Elec.	23/6	21/–	5½	5½	21/6	—	5 2 4
Lond. Assoc. Electric ...	32/9	28/–	7	7	29/6	—	4 13 4
London Electric	36/3	32/–	7	7	33/–	—	4 4 10
London Power Deb. Red.	108¾	100	5	5	106	—	4 14 6
Metropolitan	51/–	41/–	10	12	48/3	—	4 19 7·
Midland Counties	39/9	33/–	8	8	35/–	—	4 11 6
Mid. Elec. Power	41/9	37/–	8	9	40/–	—	4 10 0
Newcastle Elec.	31/9	27/6	7	7	28/9	—	4 17 4
North Eastern Electric:							
Ordinary...	34/–	25/–	7	7	30/–	—	4 13 4
7% Pref....	34/–	30/–	7	7	32/–	—	4 7 6
Northampton	47/6	43/9	10	10	46/3	—	4 6 7
Notting Hill 6% Pref. (£10)	14⅝	13⅛	6	6	13⅛	—	4 12 4
North Met. Elec.:							
Ordinary...	49/–	43/–	10	10	45/–	—	4 9 0
6% Pref....	30/6	28/3	6	6	29/–	—	4 2 9
Richmond Elec.	30/6	28/–	7	7	28/9	—	4 17 5
Scottish Power	38/9	32/–	8	8	35/–	—	4 11 6
Southern Areas	22/9	18/6	4½	5	21/3	—	4 14 1
South London	32/6	31/–	7	7	31/6	—	4 9 0
West Devon	23/3	21/3	5	5	1⅛	—	4 9 0
West Glos.	19/–	16/9	2	2	19/6	—	2 1 0
Yorkshire Elec.	42/–	36/9	8	8	38/6	—	4 3 0
Overseas Electricity Companies							
Atlas Elec.	4/6	2/6	Nil	Nil	2/9	—	—
Calcutta Elec.	44/3	36/3	12*	10*	38/9	–⅛	5 3 3
Cawnpore Elec.	40/–	35/–	10	10	35/–	–⅛	5 14 3
East African Power ...	28/3	22/6	7	7	24/–	—	5 16 8
Jerusalem Elec.	26/9	23/3	5	6	24/–	—	5 0 0
Kalgoorlie (10/–)	12/–	9/6	7½	7½	10/3	—	7 6 4
Madras	34/6	28/9	8*	8*	30/–	—	5 6 8
Montreal Power	31¾	26¾	1½	1½	33	—	—
Palestine Elec. "A" ...	31/9	27/–	7½*	7½*	30/–	—	5 0 0
Perak Hydro-electric ...	25/3	17/–	7	6	18/9	—	6 8 1
Shawinigan Power ...	23½	16½	65cts.	85cts.	23	+1	—
Tokyo Elec. 6%	65½	39	6	6	53½	+1	11 4 4
Victoria Falls Power ...	76/3	55/–	12	13½	68/9	—	3 18 6
Whitehall Investments Pref.	22/3	15/–	7½	7½	16/3	–⅛	9 4 8
Public Boards							
Central Electricity:							
1950–70	115¾	97	5	5	110½	—	4 10 6
1955–75	118½	100	5	5	113½	—	4 8 1
1951–73	111	95	4½	4½	106½	—	4 4 6
1963–93	101	85	3½	3½	94½	–1	3 14 1
London Elec. Trans. Gtd.	93½	88	2½	2½	88½	—	2 16 6
London & Home Counties,							
1955–75	112¾	97½	4½	4½	108xd.	—	4 3 4
Lond. Passenger Transport:							
A	119½	104¾	4½	4½	111½	—	4 0 9
B	122¾	105	5	5	116½	—	4 5 10
C	84	68	4½	4	74	—	5 8 1
West Midlands Joint Elec.,							
1948–68	115½	102½	5	5	113	—	4 8 6
Telegraph and Telephone							
American Tel. & Tel. ...	160	114	9	9	162½	+2	5 10 9
Anglo-Am. Tel.:							
Pref.	115½	100⅜	6	6	100½	—	5 19 5
Def.	28	23	1½	1½	23½	—	6 7 8
Anglo-Portuguese	23/6	19/3	8	8	21/3	—	7 10 7
Cable & Wireless:							
5½% Pref.	104	76½	4½	5½	80	+3½	6 17 6
Ord.	67⅜	34	—	4	39½	+4	10 5 2
Income	102½	99	—	—	100	+½	4 0 0
Canadian Marconi $1 ...	6/6	3/9	—	Nil	4/9	+3d.	—
Globe Tel. & Tel.:							
Ord.	32/6	26/3	5½*	7½*	26/3	+6d.	5 14 3
Pref.	27/6	23/9	6	6	26/3	—	4 11 5
Great Northern Tel. (£10)...	42½	34	20	20	37	—	5 8 1
Inter. Tel. & Tel.	12½	5⅜	Nil	Nil	9½	–⅜	—
Marconi-Marine	30/6	21/6	10	7½	23/9	—	6 6 4
Oriental Telephone Ord. ...	59/3	2½	12*	12*	2⅜	—	4 11 3
Radio Corpn.	9½	4⅜	8	6	8⅛	—	—
Telephone Props	13/9	11/3	5	6	13/9	—	8 14 6
Telephone Rentals (5/–) ...	10/–	7/6	5	6	9/3xd.	—	3 5 0
Western Union	34½	17	2¾	—	25½	+½	—
Traction and Transport							
Anglo-Arg. Trams:							
First Pref.	11/–	2/6	Nil	Nil	5/–	+⅛	—
4% Inc.	31	8	Nil	Nil	10	+1	—
British Electric Traction:							
Def. Ord.	1060	675	5	6	900	—	—
Pref. Ord.	175	150	8	8	160	—	5 0 0
Bristol Trams	45/–	34/3	5	8	43/9	+½	3 13 1
Brazil Traction	14½	7½	$1	—	9½	–	—
Calcutta Trams	26/9	21/6	8	8	24/6	—	6 10 8
Cape Elec. Trams	18/6	15/6	5	6	17/6	—	6 17 2
Lancs Transport	35/3	29/3	10	10	36/3	—	5 10 3
Mexican Light:							
1st Bonds	39	16½	5	5	25	—	—
Rio 5% Bonds	91	47	5	5	50	—	10 0 0
Southern Rly:							
5% Prefd.	87	48	5	—	57½	–½	—
5% Pref....	116	83	5	5	91¼	–1	5 9 3
T. Tilling	60/–	36/6	10	10	43/3	—	4 14 1
Tilling & B.A.	57/–	46/–	6	10	50/–	—	4 0 0
West Riding	46/3	30/6	10	10	33/9	—	—
Equipment and Manufacturing							
Aron Electricity Ord. ...	40/3	31/–	15	15	1⅛	—	9 12 0
Assoc. Elec.:							
Ord.	45/3	32/–	10	10	39/–	—	5 2 8
Pref.	38/9	35/6	8	8	36/–	—	4 9 0
Automatic Telephone & El.	43/–	35/–	5	10	41/3	—	4 17 1
Babcock & Wilcox ...	44/–	32/6	10	10	38/3	—	5 10 8
British Aluminium Ord. ...	54/–	40/–	10	12½	55/–	—	4 11 0
British Insulated Ord. ...	95/9	77/–	20	20	4⅛	—	4 15 10
British Thermostat (5/–) ...	16/–	9/–	17½	18½	15/9	—	5 17 6
British Vacuum Cleaner (5/-)	35/9	27/–	40	40	22/–xr.	—	—
Brush Ord.	5/6	4/9	Nil	Nil	5/–	—	—
Callender's	5½	78/6	20	20	77/6	—	5 3 3
Chloride Elec. Storage ...	77/9	61/·	15	20	77/6	—	5 3 3
Consolidated Signal ...	116/–	75/–	30	36½	4⅛	—	7 18 0
Crabtree (10/–)	29/–	22/–	17½	17½	23/9	+6d.	7 7 4
Crompton Parkinson:							
Ord. (5/–)	32/3	18/9	12½	15	15/3	—	—
E. K. Cole (5/–)	8/9	4/6	5	10	6/–	—	8 6 8
Elec. & Musical Industries							
(10/–)	16/3	9/–	10	5	10/9	—	4 13 0
Electric Construction ...	36/–	31/–	10	12½	32/6	—	7 13 10
Enfield Cable Ord. ...	5⅝	46/–	25	25	2⅝	—	—
Electrical Switchgear (10/–)	27/–	22/6	16	16	25/9	—	6 4 4
English Electric	33/–	24/6	Nil	10	33/–	—	6 1 3
Ensign Lamps (5/–) ...	14/3	11/3	—	25	14/6	—	8 12 6
Ericsson Tel. (5/–) ...	2⅛	31/–	25*	25*	2	+⅛	3 2 6
Ever Ready (5/–)	26/3	16/6	45	35	21/–	—	8 6 8
Falk Stadelmann	34/3	27/–	10	10	27/6	—	7 5 6
Ferranti Pref.	27/6	25/–	7	7	25/–	—	5 12 0
G.E.C.:							
Pref.	34/–	31/3	6½	6½	31/3	—	4 3 2
Ord.	79/3	67/–	17½	20	76/0	–6d.	5 5 3
Greenwood & Batley ...	27/6	19/–	7	15	26/3	—	11 8 6
Hall Telephone (10/–) ...	24/6	18/3	5	15	21/3	—	7 1 2
Henley's (5/–)	21/–	16/–	15	20	19/6	—	5 2 7
4½% Pref.	23/–	22/–	4½	4½	22/6	—	4 0 0
Hopkinsons	40/–	32/6	10	12½	38/9	—	6 8 10
India-Rubber Pref. ...	21/9	20/3	5½	5½	21/3	—	5 3 6
Intl. Combustion	5/8	4½	30	32½	5⅜	—	6 0 10
Ismay Industries (5/-) ...	6/9	1/–	6	6	1/–	–3d.	—
J. Lucas	57/9	47/6	15	15	56/3	—	5 6 9
Johnson & Phillips ...	43/9	32/6	10	12½	35/–	—	7 2 10
Lancashire Dynamo ...	72/3	53/–	20	25	65/–	—	7 14 0
Laurence Scott (5/–) ...	12/–	9/–	7	15	12/–	—	6 5 0
London Elec. Wire ...	35/–	28/3	12	7½	30/–	—	5 0 0
Mather & Platt	49/–	41/3	12	13½	47/6	+⅛	5 13 8
Metropolitan Elec. Cable Pf.	22/–	21/–	5½	5½	21/3	—	5 3 6
Murex	93/9	66/3	20	20	73/9	–⅛	5 8 5
Pye Deferred (5/–) ...	12/–	8/–	5	25	9/0	–6d.	13 18 0
Revo (10/–)	36/3	30/–	12	17½	35/–	—	5 0 0
Reyrolle	62/6	49/–	12½	12½	55/9	—	4 10 0
Siemens Ord.	31/–	20/6	7½	7½	21/3	—	6 13 4
Strand Elec. (5/–) ...	6/–	4/–	5	10	5/–	—	10 0 0
S. Smith (1/–)	9/9	6/3	37½	50	8/9	—	6 6 0
Switchgear & Cowan (5/–)	19/6	12/6	20	20	15/–	—	6 13 4
Telegraph Condenser (10/–)	18/9	12/–	5	5	10/–	—	5 0 0
Telegraph Construction ...	2⅛	36/–	7½	10	2⅛	—	4 14 1
Telephone Mfg. (5/–) ...	9/9	7/–	9	9	8/6	—	5 6 0
Tube Investments... ...	89/6	70/–	23⅜	23⅜	85/9	+6d.	5 10 8
Vactric (5/–)	9/9	4/6	10	4	3/3	—	6 3 2
Vickers (10/–)	27/–	17/6	10	10	22/9	–9d.	4 8 0
Westinghouse Brake ...	53/9	45/–	17½	17½	53/–	–1/–	6 12 1
Walsall Conduits (4/-) ...	26/–	22/6	—	55	25/9	—	8 11 0
West, Allen (5/–)	6/6	4/6	—	7½	6/6	—	5 15 5

* Dividends are paid free of Income Tax.

NEW PATENTS

Electrical specifications recently published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1937

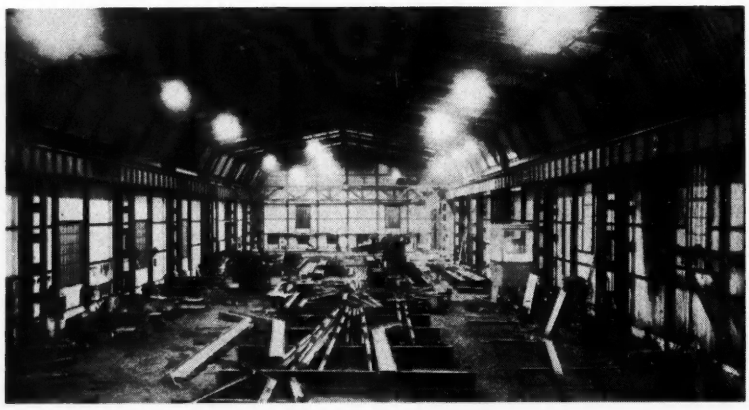
7295. "Low-frequency thermionic amplifying systems and the like." A. A. Fayers. March 12th, 1937. (497319).

10205. "Radio direction and range finding apparatus." British Thomson-Houston Co., Ltd. April 9th, 1936. (497147.)

10347. "Thermionic-valve oscillators and amplifiers." P. W. Willans and Muirhead & Co., Ltd. April 12th, 1937. (497148.)

13109. "Electric lamp attachments." A. D. Froggatt and Simplak Batteries. May 7th, 1937. (497091.)

13412. "Armouring of electric cables." Sir T. F. Purves, T. R. Scott, W. H. L. Lythgoe and H. J. Allcock. May 11th, 1937. (497259.)



A sodium lighting installation has recently been completed in the girder manipulation shop of the British Steel Co.'s works at Wednesbury. Planned by the illuminating engineering department of Rowlands Electrical Accessories, Ltd., the installation consists of the company's No. 926 150-W mirror-lined sodium dispersive lighting units with "Philora" lamps and control gear

13579. "Electric switches employing mercury or other conducting liquid." A. Cianchi. May 13th, 1937. (497323.)

13656. "Coupling transformer system for television arrangement." Radioakt. Ges. D. S. Loewe. May 16th, 1936. (497217.)

13668. "Road-traffic control systems." Siemens & General Electric Railway Signal Co., Ltd., F. A. Downes and H. J. N. Riddle. May 14th, 1937. (497324.)

15808. "Electric fusible cut-outs." F. R. W. Strafford and Belling & Lee, Ltd. June 8th, 1937. (497153.)

16173. "Electric insulators." C. L. Snow and Imperial Chemical Industries, Ltd. June 10th, 1937. (497262.)

16269. "Common wave radio transmitting systems." C. Lorenz Akt. Ges. June 18th, 1936. (497224.)

16429. "Single-cable electrical well-logging." Standard Oil Development Co. June 25th, 1936. (497329.)

16439. "Internal combustion engine installations with electric power transmission." Sulzer Freres Soc. Anon. June 27th, 1936. (497229.)

16475. "Battery holders for electric clocks." F. A. Lanfranconi and British Vacuum Cleaner & Engineering Co., Ltd. June 14, 1937. (497231.)

16490. "Electric connecting cables or power leads." Siemens Schuckertwerke Akt. Ges. June 15th, 1936. (497391.)

16592. "Means for adjusting the electrodes of electric furnaces." W. W. Groves (Akt. Ges. für Stickstoffdunger). June 15th, 1937. (497272.)

16626. "Resistance-regulating switches for dynamo-electric machines." British Thomson-Houston Co., Ltd. June 16th, 1936. (497278.)

16708. "Vibrator commutator switching devices for converting direct into alternating current." Marconi's Wireless Telegraph Co., Ltd. June 16th, 1936. (497341.)

16727. "Electrical signalling systems and delay circuits for use therein." B. M. Hadfield. June 16th, 1937. (Cognate application 19627/37.) (497396.)

16762. "Variable reactance transformers." British Thomson-Houston Co., Ltd., and J. G. Wellings. June 16th, 1937. (497286.)

16770. "Modulated carrier-wave transmitters." Marconi's Wireless Telegraph Co., Ltd., and J. Twatt. June 16th, 1937. (497343.)

16783. "Electro-magnetic relays." Automatic Telephone & Electric Co., Ltd., O. A. Pearce and J. St. C. W. Graham. June 16th, 1937. (497344.)

16903. "Control of synchronous dynamo-electric machines." British Thomson-Houston Co., Ltd. June 17th, 1936. (497354.)

16967/68/70. "Vacuum electric tube devices." J. M. Dodds and Metropolitan-Vickers Electrical Co., Ltd. June 18th, 1937. (497359/60/62.)

16969. "Thermionic valves and electrodes therefor." J. M. Dodds and Metropolitan-Vickers Electric Co., Ltd. June 18th, 1937. (497361.)

17018. "Supply circuits for thermionic valves." Standard Telephones & Cables, Ltd., R. A. Meers and F. G. Filby. June 18th, 1937. (497364.)

17045. "Electric motors." British Thomson-Houston Co., Ltd. June 18th, 1936. (497403.)

17052. "Picture-transmision systems." P. M. G. Toulon. June 19th, 1936. (497367.)

17053. "Television receivers." P. M. G. Toulon. July 9th, 1936. (497404.)

17083. "Relay switching circuits." General Electric Co., Ltd., and J. Scowcroft. June 19th, 1937. (497238.)

17086. "Amplitude filter for the separation of synchronising impulses in television reception." E. P. Rudkin. June 19th, 1937. (494371.)

17111. "Connection of screened ignition cables." R. Bosch Ges. June 23rd, 1936. (497372.)

17118. "Electron-discharge devices for use in television, for example." B. M. Crowther. June 19th, 1937. (497406.)

17846. "Electric fires or heaters." Simplex Electric Co., Ltd., P. W. Davis and A. V. Barton. June 26th, 1937. (497242.)

18801. "Stand and reflector for an electric or other lamp." A. G. Horton. July 6th, 1937. (497379.)

20074. "Alarm mechanism for electric clocks." H. E. Moore and W. J. Rickets. July 20th, 1937. (497294.)

20618. "Electrical resistors." General Electric Co., Ltd., and M. Pirani. July 26th, 1937. (Cognate application 11970/38.) (497107.)

20743. "Auxiliary electrodes for electric discharge devices." General Electric Co., Ltd., and E. H. Nelson and M. Pirani. July 27th, 1937. (497108.)

20815. "Electric motor control systems." Westinghouse Electric & Manufacturing Co. July 31st, 1936. (Addition to 480761.) (497246.)

21046. "Amplifiers for electron current." British Thomson-Houston Co., Ltd. July 30th, 1936. (497160.)

22804. "Electric transformers." British Thomson-Houston Co., Ltd., and P. Matthews. August 19th, 1937. (497162.)

27186. "Electrical apparatus for heating air." E. K. Cole and W. Coates. October 7th, 1937. (497250.)

28378. "Frequency modulated carrier-wave systems." Marconi's Wireless Telegraph Co., Ltd. November 27th, 1936. (497111.)

35616. "Large thermionic valves." M-O Valve Co., Ltd., and R. Le Rossignol. December 23rd, 1937. (497115.)

35938. "Incandescent lamp holders." E. Gossel. December 28th, 1937. (497173.)

35941. "Television receivers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. December 30th, 1936. (497116.)

1938

1472. "Means for connecting electric wires to the terminals of lampholders, adapters and the like." T. Glen. January 17th, 1936. (497117.)

9056. "Electric sockets." British Thomson-Houston Co., Ltd. March 25th, 1937. (497127.)

10259. "Party-line communication systems." Mix & Genest Akt. Ges. April 3rd, 1937. (497193.)

10538. "Electric switches responsive to direction of rotary motion." British Thomson-Houston Co., Ltd. April 6th, 1937. (497195.)

12004. "Electric arc welding." H. G. Bouly (Soudure Electrique Autogene Soc. Anon.). April 21st, 1938. (497133.)

12512. "Secret telephone communication systems." Standard Telephones & Cables, Ltd. May 15th, 1937. (497198.)

16777. "Electron-discharge devices." Standard Telephones & Cables, Ltd. June 30th, 1937. (497138.)

16885. "Alternating-current motor with low-voltage lamp taps." H. G. C. Fairweather (Singer Mfg. Co.). June 7th, 1938. (497205.)

17884. "Magnetos." R. Bosch Ges. June 16th, 1937. (497139.)

19665. "Ultra short-wave receiving sets." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 5th, 1937. (497206.)

TRADE MARK APPLICATIONS

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 4th:—

Armatite. No. 584397. Class 50 (III). Electrical insulating material, in sheet form, composed of mica composition or composed of varnish-impregnated textile fabric backed with paper, with vulcanised fibre material, or with textile material, the impregnated fibre predominating.—The Micanite & Insulators Co., Ltd., Empire Works, Blackhorse Lane, Walthamstow, E.17.

Viceroy. No. 583969. Class 50 (III). Electric light fittings and other goods, all being made from thermoplastic moulding materials having a basis of synthetic resin, cellulose derivatives or bitumen.—Wilmot-Breeden, Ltd., Eastern Works, Camden Street, Birmingham.

Phenite. No. 601377. Class 2 (IV). Resins (artificial or natural) and mouldable powders made therefrom.—Cellomold, Ltd., Browell's Lane, Feltham, Middlesex.

Goblin-Monarch. No. 601469. Class 10 (IV). Suction cleaning machines (electric).—The British Vacuum Cleaner and Engineering, Co., Ltd., Goblin Works, Ermyn Way, Leatherhead, Surrey.

Aquaflorium. No. 602799. Class 11 (IV). Table lamps, pedestal lamps, lampshades and lampshade holders.—Sisabro Novelty Co., Ltd., 339, City Road, E.C.1.

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Aberdeen. — January 20th. County Council. Electrical works at Alford Police Station. M. Heddle, county road surveyor and engineer, 25, Union Terrace,

Australia. — MELBOURNE. — February 20th. City Council. Forty-eight ring main isolating switches. (T. 30666/38.)*

February 6th. High- and low-voltage cables and cable jointing material. (T. 30874/38.)*

Posts and Telegraphs Department. February 21st. Insulating materials. (T. 30879/1938.)*

Postmaster-General's Department. February 28th. Protectors, mountings, fuses, heat coils, mica, carbons and fuse wire. (T. 30926/1938.)*

February 21st. Cable (T. 30832/38.)*

March 7th. Insulated wire. (T. 30928/1938.)*

March 7th. Telephone jacks and number plates. (T. 30878/38.)*

Aylesbury.—January 30th. Electricity Department. Electrical apparatus and materials for twelve months. (January 6th.)

Belfast.—January 27th. Electricity Department. Pipework and valves, steam-pipe drainage system, steam separator and stop valve and 100-kW mercury-arc rectifier equipment. (See this issue.)

Birmingham.—January 16th. Salvage and Stables Committee. Eight electric battery driven vehicles. General manager, Salvage Department, 161, Corporation Street (deposit £1 1s.).

Blackpool.—January 23rd. Corporation. Stores and materials for twelve months. (January 6th.)

Bootle.—January 30th. Watch Committee. Sodium and mercury electric discharge lighting. (January 6th.)

Bradford. — January 14th. Electric lighting and heating installation at the Technical College extensions. Town Clerk, Town Hall.

Bristol.—January 20th. Port of Bristol Authority. 300-kVA, 6,600-V kiosk substation and extra-high-voltage switchgear having a rupturing capacity of 150,000-kVA. Secretary, 19, Queen Square (deposit £2).

Cardiff.—January 16th. Electricity Department. Six 1,000-kVA transformers. (December 30th.)

Crook and Willington.—U.D.C. The supply and erection of overhead network at Firtree. Plans by E. C. Lennox, Carliol House, Newcastle-on-Tyne.

Dover. — January 30th. Corporation. Extra-high- and low-voltage cables and oil-cooled transformers for twelve months; mercury-discharge street lighting equipment. (See this issue.)

Erith.—January 23rd. Electricity Department. Wiring and installation of emergency lighting equipment, plant and tools for workshop, neon sign equipment and 16-mm. projector, sound apparatus and screen for new electricity offices and showrooms, Peir Road. (January 6th.)

Farnworth.—January 26th. Electricity Department. Low-voltage p.i. cables. (January 6th.)

Gloucestershire. — Education Committee. Electric lighting in new infants' council school at Kingswood, Bristol. County architect, Shire Hall, Gloucester.

Hastings.—January 25th. Electricity Department. Stores and materials for periods of one, two, and three years. (January 6th.)

Hull.—Telephone Committee. Lead-covered telephone cables. (See this issue.)

January 17th. Electricity Department. Stores and materials for twelve months. (December 30th.)

India.—January 31st. Steel rolling mill with electrical equipment. Director-General, India Store Department, Belvedere Road, London, S.E.1 (deposit 5s.).

Kingston-upon-Thames.—January 28th. Electricity Department. Stores and materials for twelve months. (See this issue.)

Liverpool. — January 13th. Electric Supply Department. Materials for twelve months. (December 30th.)

London.—H.M. OFFICE OF WORKS.—January 20th. Switchgear, transformers, &c., for sub-station at Glascoed R.O.F. (December 30th.)

January 27th. Extra - high - voltage switchgear, batteries, &c., at Glascoed R.O.F. Extra-high- and low-voltage switchgear, cables, batteries, &c., at Pembrey R.O.F. (January 6th.)

January 20th. Propeller-driving motors and motor-generator set for the National Physical Laboratory, Teddington. January 6th.)

January 27th. Low-voltage and telephone cables for Chorley R.O.F. Heapey Depôt. (January 6th.)

February 3rd. High- and low-voltage cables and accessories at Glascoed R.O.F. (See this issue.)

February 3rd. Transformers for Glascoed and Pembrey R.O.F. (See this issue.)

BATTERSEA.—February 8th. Borough Council. Stores and materials for twelve months. (See this issue.)

HAMMERSMITH.—January 25th. Borough Council. General electricity stores for twelve months. (January 6th.)

BETHNAL GREEN.—January 27th. Electricity Department. Glazed earthenware ducts, electric lamps, 250-V v.i.r. and lead-covered cable, joint and cable box compound, switches, lampholders, glass shades, dry batteries, torches, conduit and fittings, service boxes, meters, high- and low-voltage cables and electric cookers. (January 6th.)

Manchester.—January 18th. Electricity Committee. Domestic electric cookers for twelve months. (December 30th.)

January 26th. Reserve water tank and pipework and 300-Ah battery and charging equipment for Barton power station. (January 6th.)

Newton-in-Makerfield.—February 6th. Electricity Department. P.i. cables for twelve months. (See this issue.)

New Zealand.—WELLINGTON.—January 31st. Public Works Department. Cable. (T. 30679/1938.)*

February 21st. Four 250-kVA single-phase transformers. (T. 30678/38.)*

February 28th. Four 333-kVA transformers. (T. 30910/1938.)*

Northumberland. — County Council. Installation of electricity in the Belford Senior School. Plans by W. W. Tasker, county architect, County Hall, Newcastle-on-Tyne.

Paisley.—January 18th. Corporation. Electrical installation at shopping centre, Ferguslie Park. Town Clerk.

Portsmouth.—January 23rd. Electricity Undertaking. High-voltage cables and fire protection equipment for 6.6-kV switch house. (December 30th.)

Rhyl.—January 24th. Electricity Department. Low-voltage cables, cut-outs and meters for twelve months. (January 6th.)

Rothesay.—February 2nd. Electricity Department. Diesel engines for a 500-kW Diesel alternator set, complete with switchgear and accessories. (See this issue.)

South Africa. — PRETORIA. — January 25th. City Council. Lighting fittings and auxiliaries for trolley-bus poles and 1,300 ft. of high-voltage cable. (T. 30539/38.)*

February 9th. Union Tender & Supplies Board. One 50-V switchboard and associated equipment. (T. 30622/38.)*

JOHANNESBURG.—January 28th. City Council. Portable AC electric welding set. (T. 30436/38.)*

CAPE TOWN.—February 1st. Electricity Supply Commission. Two 500-kVA three-phase transformers, high- and low-voltage and pilot cable and one complete 380-V switchboard. (T. 30893/38.)*

March 1st. Electricity Department. Outdoor type transformers. (T.Y. 30892/38.)*

Southend-on-Sea.—February 9th. Electricity Department. General stores for twelve months. (January 6th.)

Sunderland.—Town Council. Electrical installation in the outpatients' department at the Municipal Hospital. Plans by J. E. Lewis, borough engineer.

Swansea. — January 31st. Electricity Department. Stores and materials for twelve months. (See this issue.)

Uruguay. — MONTEVIDEO. — February 1st. State Electricity Supply and Telephones Administration. 7,000 subscribers' telephone sets. (T.Y. 30974/38.)*

Walthamstow.—February 3rd. Corporation. Electrical installation at new branch library at Wood Street. (See this issue.)

York.—January 25th. Committee of Visitors. Complete electric lighting in the nurses' home extension at the North Riding of Yorkshire Mental Hospital. (See this issue.)

Orders Placed

Bolton.—General Purposes Committee. Accepted. Amplification equipment at Albert Hall.—Electrical Engineering Service.

Bradford. — General Purposes Committee. Accepted. Lighting equipment for Crossflatts trolley-bus route (£1,447). —G.E.C.

Bromsgrove.—Bromsgrove, Droitwich and Redditch Joint Hospital Board. Accepted. Electrical work in connection with extensions to the Hospital.—T. Glover.

Glasgow.—Transport Committee. Accepted. Tramcar heaters.—J. P. Tubular Heater Co. Telephone and test cable.—Craigpark Electric Cable Co. Feeder panels and equipment for Whitevale sub-station.—J. G. Statter & Co.

Hastings.—Electricity Committee. Recommended. Fire protection equipment (£300).—Walter Kidde Co. Transformers. —Bryce, Ltd. (£750); Bonar, Long & Co. (£105).

Inverness.—Town Council. Accepted. Electrical work for 100 houses at Dalneigh.—D. Johnstone.

Leeds.—Gas Committee. Accepted. Turbo booster (£1,680).—Bryan Donkin Co.

Electricity Committee. Accepted. Coal preparation plant (£97,224) and boiler house plant (£254,250).—International Combustion, Ltd. Switchgear (£875).—G.E.C.

Liverpool.—Hospitals Committee. Accepted. Mill Road Infirmary: One 150-kW electric generator (£1,985).—W. H. Allen & Sons. Automatic telephone system (£1,175).—Automatic Telephone & Electric Co.

Electric Power & Lighting Committee. Accepted. One nickel alkaline battery (£358 less £11 allowance for worn-out battery).—Britannia Batteries.

London. — L.C.C. — Electrical installation at the nurses' home at Mile End Hospital:

Electrical Installations.	**Accepted**	£
Archibald Meckhonik	... ...	**2,158**
Arthur Cozens ...	... ...	2,358
Read and Partners	... ...	2,374
Buchanan & Curwen	... ...	2,410
H. J. Cash & Co. ...	... ...	2,507
Atozed (London) ...	... ...	2,546
Pinching & Walton	... ...	2,552
T. Clarke & Co. ...	... ...	2,626
F. H. Wheeler & Co.	... ...	2,638
A. J. Hewens & Sons	... ...	2,662
Blackburn, Starling & Co.	... ...	2,720
Francis Polden & Co.	... ...	2,830
		2,885

Peterborough. — Town Council. Accepted. 1,000 electric cookers (£8,850).—Simplex Electric Co.

Portsmouth.—General Purposes Committee. Accepted. Internal telephone system at Guildhall (£1,068).—Reliance Telephone Co.

Scarborough.—Town Council. Accepted. Additional 11,000-V switchgear unit for the Northstead Manor Gardens sub-station (£184).—Ferguson, Pailin.

Sleaford.—Housing Committee. Accepted. Wiring nine houses in Newfield Road (£65).—J. T. Barnes & Son.

Sunderland.—Town Council. Accepted. Electrical installation at the Hendon Road plunge baths (£151).—F. Reid, Ferens & Co.

Torquay.—February 3rd. Corporation. Electric lamps for twelve months.—Town Clerk.

Wakefield. — Education Committee. Accepted. Wiring at Snapethorpe school extensions.—G. Ashton.

Wolverhampton. — Electricity Committee. Accepted. Transformers: Two 500-kVA indoor (£426), one 500-kVA outdoor (£231), three 300-kVA indoor (£459), two 200-kVA indoor (£242), and two 50-kVA outdoor pole type (£120).—Electric Construction Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Accrington. — School, Springhill (£26,000), for Father T. McAvoy; Hill, Sandy & Norris, architects, 9, Albert Square, Manchester.

Barking.—Premises, Ripple Road, for E. Glenny & Son, Ltd.

Barnsley.—Houses (22), Queen's Drive, for Vernon Dunk, Ltd., 43, Granville Street; F. Birkinshaw, architect, Pogmoor, near Barnsley.

Barnstaple.—Nurses' home and extensions to wards, North Devon Infirmary; J. C. Southcombe, architect, Cross Street.

Birmingham. — Airport buildings (£60,000) and flats, Moseley and Hutton estates; city engineer. Factory and offices, Alcester Street; W. C. Skinner, Ltd., builders, Birchfield Road. Enlargement of Paget Road school (£13,600) and improvements to Shawbury school (£15,200), for the E.C.

Blackhill (Co. DURHAM).—Houses (72); R. Gallagher, contractor, Cemetery Road.

Blyth.—School, Gordon Road; borough engineer.

Bolton.—School, Lever Edge Lane, for the E.C. School, White Bank (£40,000); G. & J. Seddon, Ltd.

Bromsgrove.—Extensions to the Isolation Hospital (£34,475), for the Bromsgrove, Droitwich and Redditch Joint-Hospital Board; J. & A. Brazier, builders, Worcester Road, Bromsgrove.

Broomhill (Co. DURHAM).—Cinema; J. N. Fatkin, architect, 17, Bigg Market, Newcastle-on-Tyne.

Bury St. Edmunds.—Bus station at the corner of Cornhill and Brentgovel Street, for the Eastern Counties Bus Co., Ltd.

Chelmsford. — Houses (20), Second Avenue; H. Jackson & Co. Estate development, Haddow Road, for W. J. Legg; W. M. Edwards. School, Rainsford (£41,954), for the E.C.; J. A. Perriss, Ltd., builders, Acton.

Chesterfield.—Houses (21), Brooklyn Drive; F. Longden.

Chesterton.—Houses (36); J. R. Oxenham, R.D.C. architect, County Hall, Hobson Street, Cambridge.

Chippenham.—Houses (122), Hungerdown; borough surveyor.

Chorley.—Works, Dark Lane, for J. Mawdesley (Baskets), Ltd.

Chulmleigh.—Houses (20), Alms Meadow site, for South Molton R.D.C.; C. N. B. Willey, clerk, Council Offices, South Molton.

Cookley (KIDDERMINSTER). — Mental colony, Lea Castle estate, for the West Midlands Joint Board for Mentally Defectives; Sheppard and Partners, architects, Bedford Place, Bloomsbury Square, London, W.C.1.

Coventry.—Houses (35), Abbey Road and Ashington Grove; James and Edwards, 141, Spon Street. Houses (20), Road "A." Lyng Hall estate; Drayco, Ltd., Draycott, near Worthing, Sussex. Houses (59), Sullivan Road; W. R. Lane & Son, Ltd., Fisher Road.

Doncaster. — Factory, Wheatley, for T. B. Morley & Co., Jameson Street, Hull; W. Firth, Ltd., contractors, Lockwood Street, Doncaster.

Dumbarton.—Cottage hospital for T.C.; burgh surveyor.

Durham.—Schools, Cockfield Butterknowle, Murton and Seaham Harbour, for the County E.C.; county architect, 34, Old Elvet, Durham.

East Ham.—Extensions to East Ham War Memorial Hospital (£30,000); J. W. Lohden, architect, 19, Plashet Grove, London, E.6.

Edinburgh.—Factory, for P. Stephenson & Co.; C. MacAndrews & Partners, contractors.

Enfield.—Houses (55), Lansbury Road; Swannell & Sly. Flats (84), Lansbury Road; R. Bohen.

Essex.—Convalescent hospital, Pyrgo Park, Romford, for the C.C.; J. Stuart, county architect, County Hall, Chelmsford.

Frodsham. — Houses (96), Church Street, and houses (57), Flinn Lane; Atlas Building Co., Ltd., Warrington.

Glasgow.—Extensions to St. Philomena's School (£66,000); Education director.

Gorleston-on-Sea.—Houses (12), Riverside Road; R. G. Clarke.

Great Yarmouth.—Flats (198), clearance areas; borough engineer.

Halifax.—Houses (294), Backhold Lane estate, and 110, Nursery Lane estate; borough engineer. Extensions to Technical College (£148,00), Francis Street; E.C.

Hastings.—Houses (46), Old Town; S. Little, borough engineer, 37, Wellington Square.

Hebburn-on-Tyne.—Houses (36); A. V. Clerey & Son, contractors, 14, Frederick Street, South Shields.

Hebden Royd.—Houses (52), Nest Lane, Mytholmroyd; U.D.C. surveyor.

Hertford.—Houses, Horns Mill, for the T.C.; Elliott & Archer, architects.

Hetton (Co. DURHAM).—Houses (85), Peat Carr estate, and 135 houses, Low Moorsley, for the U.D.C.; A. H. Fennell and Co., architects, Bridge End Chambers, Chester-le-Street.

Hull.—Baths, Bilton Grange (£45,000), and market and abattoir (£280,000); city engineer.

Ilkeston.—Extensions to factory, Awsworth Road; A. Booth & Son, Ltd.

Keighley.—Houses (12), Whitley Road; Hird Bros. & Co., Ltd. Extensions to works; W. Sellers & Sons, Airedale works.

Kendal.—Houses (324), Sandylands; G. German, borough surveyor.

Leamington Spa.—Houses (86), Melton Road, Braemar Road, &c.; C. J. Knight.

Leeds.—Office and stores, Bramley; J. E. Acfield, engineer, City Hall, Leeds.

Leicester. — Houses (600), Scraptoft area, for the Wyvern Property Co., Leicester; William Davis & Co. (Leicester), Ltd., contractors, Park Road, Loughborough.

Lewes.—Houses (80), Landport estate, for the T.C.

Liverpool.—Houses (200), Manor Road, Hunt's Cross Avenue, Linkside Road, Mackett's Lane; Pierce, Williams & Son, 141, Upper Warwick Street. Houses (37), Walsingham Road, for W. & T. Armour Williams, 24, Dale Street; R. Owens & Son, architects, Westminster Buildings, 3, Crosshall Street. Flats (29), Alexandra Drive, for Glyn Trust, Ltd.; A. E. Shennan, architect, North House, 17, North John Street. Office and workshops, Cheapside, for Kelly Bros., Ltd., Estate Office. 465, Rice Lane. Liverpool, 9; S. McLauchlan and S. B. Howard, architects, Royal Liver Buildings, Liverpool, 3. Nine shops and flats, Woolton Road; J. W. Jones and Sons, 158, Allerton Road. Extensions to Abattoir (£35,460); city engineer.

London.—(SOUTHWARK).—Factory, Bittern Street; George Lansdown & Devereux, 6, Grosvenor Street, W.1.

Manchester.—Houses (18), Parkside Road, Wilbraham estate, and branch libraries, Collyhurst and Ardwick; city architect. Motor bus depot, Wythenshawe; King & Co., Ltd. Shops, Hollyhedge Road; Moston Brick and Building Co., Ltd.

Medomsley (Co. DURHAM).—Houses (118), for the Consett U.D.C.; J. J. Eltringham, architect, Derwent Street, Blackhill.

Millom.—Houses (50), estate rear of Holborn Hill; R.D.C. surveyor.

Nantwich.—Houses (96); H. Crabtree, R.D.C. surveyor.

Northallerton (YORKSHIRE). — Houses, for the U.D.C., in connection with the South End Terrace clearance plans; U.D.C. surveyor.

Orpington.—Municipal offices (£23,400), for U.D.C.: R. Atkinson & Anderson, architects, 13, Manchester Square, London, W.1.

Ossett.—Houses (70), Swithenbank estate; borough engineer. Houses (37), Kingsway; Mr. Clough.

Peterborough.—Houses (44), new road off Mayor's Walk; W. Arbon, builder, St. Paul's Road. Extensions to works, British Braids and Bootlaces, Ltd., Burton Street.

Petworth.—Council offices, Newlands (£6,495); R.D.C. surveyor.

Plymouth.—Cinema, Stirling Road; A. F. Leest. Maternity block, City Hospital (£30,893); A. N. Coles, Ltd. School, St. Budeaux (£35,827); W. Dudley Coles.

Reading.—Houses (72), Whitley estate; borough engineer. Community centre, Whitley estate; housing architect, Town Hall.

Rotherham.—Houses (50), Blackburn Lane; J. C. Mason, Sheffield. Houses (34), Watson Road; W. J. Broadhead. School for defectives, East Bawtry Road (£27,213), for the E.C.

Rugby.—Factory, for British Thomson-Houston Co., Ltd.

Salford.—Flats, Ordsall Lane, and fire station, Broughton; borough engineer. Library, Seedley (£9,150); Moseley Construction Co., Ltd. Police headquarters and session court, The Crescent (£70,000); borough surveyor. Schools, Pendleton and Broughton; P. Howard, architect.

Sheffield.—Houses (60), near Norton Avenue; A. Smith, Denton & Co., Hartshead. Houses (32), Stradbroke Road; F. Sayles. Cutlery factory, Clay Wheels Lane: Hadfield & Cawkwell. Factory and warehouse, Bailey Street; Cole Bros., Ltd. Health centre, Attercliffe; city architect. Extensions to hospital (£9,735); Roper & Sons, Ltd.

Shelf (YORKS).—Houses (20), Cheapside, for Queensbury and Shelf U.D.C.; G. R. Oddy, architect, Ward's End Chambers, Halifax.

Shrewsbury.—Shops and showrooms, Castle Street; A. H. Woodhouse, builders, Port Hill Road.

South Shields. — Houses, Marsden Road; borough engineer. Porcelain factory, near Mile End Road; J. T. Smith, agent for the promoters, Swarland Avenue, Longbenton, Newcastle-on-Tyne.

Sunderland. — Houses (196), High Southwick No. 2 estate, for the North-Eastern Housing Association, Newcastle-on-Tyne; J. E. Lewis, architect, Town Hall, Sunderland. Factory for Messrs. Clegg: H. E. Pitt, Ltd., contractor, Leopold Street, Millfield, Sunderland. Extensions to premises, Back Holmside, for P. Wilkinson, Ltd.; G. T. Brown & Son, architects, Fawcett Street, Sunderland.

Sunnybrow (Co. DURHAM).—Houses (50), for the North-Eastern Housing Association, Newcastle-on-Tyne; J. Thorne, contractor, Rosemead Avenue, Willington, Co. Durham.

Tunbridge Wells. — Rebuilding of Eridge Castle, Eridge, for the Marquis of Abergavenny.

Uxbridge.—Houses (44), Cowley Road, Gravel Pits; Barr & Mead, Ltd., Northolt Road, South Harrow.

Wallsend-on-Tyne.—Shops, Alexandra Road, for J. McHarg; W. Riddle, architect, 53, Denham Terrace.

Wenlock.—Houses (58), Madeley and Ironbridge, for T.C.; James Hickman & Son, architects, 1, Market Street, Wellington, Shropshire.

West Hartlepool.—Hangar and clubhouse, Greatham aerodrome, for the T.C.; borough engineer.

Whitehaven.—Houses (166), Hensingham estate; borough engineer.

Wigton.—Houses (59), Aspatria, for the North Eastern Housing Association, Ltd., Newcastle-on-Tyne.

Wiltshire.—School (£53,870), Trowbridge, for the County E.C., County Offices, Trowbridge.

Wolverhampton.—Houses (36), Stafford Road: Bushbury Estate Co., Ltd. Factory, Green Lane; Tools (Wolverhampton), Ltd. Schools, Bingley Street, Low Hill (£60,500), for the E.C. Additions to Horden Road Council schools (£27,000) with electrical work; McKeand, Smith & Co., builders, Showell Road, Bushbury. Enlargement of technical college (£23,700); governors.

Worthing.—Houses (28), Field Place estate: Imrie & Angell, architects. Houses (11), Goring Way; West Sussex Coast Development Co., Ltd. Development of Lyons Farm estate, Sompting Road, for Dr. E. G. Annis; Potter & Trower, architects. Houses (26), Vale Walk; F. Kenton. Four-storey block of shops and offices, Liverpool Gardens; H. C. Wolledge, architect, 33, South Street.

Yorkshire. — School, Newby, Scarborough, for the North Riding E.C.; F. X. Velarde, architect, 3, Abercromby Square, Liverpool.